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TOTAL GASTRECTOMY FOR CANCER

A Collective Review of the Literature and an Original Report of Twenty Cases

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HISTORICAL INTRODUCTION

IN 1898 Kroenlein (132) conceived the term "total gastrectomy" as most definitive of the operation for gastric cancer. A collective review of reported cases in the medical literature, however, has shown that numerous surgeons have made the mistake of reporting incomplete or subtotal resections of the stomach as total or complete. No less a surgeon than Billroth defined the operation of total gastrectomy as resection of the stomach with anastomosis of the cardia to the pylorus. The preservation of a small portion of the cardia or pylorus would classify the resection as subtotal; the term total gastrectomy implies a complete removal of the organ and anastomosis of the esophagus to the duodenum or jejunum.

Albert, in discussing a paper by Frank on pyloric resection, stated that in 1880 he had advocated the feasibility of total gastrectomy in human beings, because he had performed the operation on a cadaver and a dog. This suggestion even antedated the first successful partial gastrectomy for cancer by Billroth on January 29, 1881. Albert mentioned the name of Professor Nicoladoni in connection with the first complete gastrectomy in man, but no exact reference to this historical incident can be found. The first known total gastrectomy in man was done by Conner (52) of Cincinnati in 1884; his patient died of shock on the operating table. The credit for the first successful performance of this operation should go to Schlatter (205, 206, 207) of Switzerland, who in 1897 effected an esophagojejunostomy in a woman aged fifty-six years. She died one year and fifty-three days later of recurrent carcinoma.

Even at that early date in the evolution of the operation, the surgeons who attempted it were cognizant of the operative complications and occasional metabolic disturbances that accompanied it. The second and third successful total ablations of the stomach were performed by the American surgeons, Brigham (28, 29) and Richardson (194, 195) in 1898. Brigham carefully studied the two years of postoperative life granted his patient and made the original observation that hematopoiesis was retarded after complete removal of the stomach. This conclusion was strengthened by the experience of Moynihan (166, 167, 168), who in 1907 reported the case of a forty-three-year-old male who died three years and eight months after total gastrectomy and esophagojejunal anastomosis. At post-mortem examination, a profound anemia was discovered, a fact which greatly impressed this able surgeon.

Richardson first mentioned the occurrence of fistula, which at necropsy nine months later was found to extend to the suture line of the esophagoduodenostomy. At the beginning of the twentieth century the Murphy button was frequently employed in all forms of gastrointestinal anastomosis. When one considers the natural hazards of esophageal anastomosis, the additional danger of any foreign body held in the suture line is readily understood. Four of every 5 patients in whom the Murphy button was employed for esophagojejunal and esophagoduodenal anastomoses, died of peritonitis. In 2 early reported instances a calcified bone bobbin was used with success.

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MacDonald (148), who performed the fourth successful operation of this kind in 1898, made note of a distressing diarrhea of which his patient complained. Little attention was paid to this phenomenon until Flint (78) in 1928 described the light, liquid stools which indicated a deficiency in fat digestion and absorption. The mechanism of this disturbance will be discussed at greater length in subsequent pages.

Frequent reference to a hearty return of appetite has been described throughout the entire history of the performance of this operation. That total gastrectomy was not inconsistent with the enjoyment of good food was attested to by a patient of Harvie (100), who in 1900, six weeks after such an operation, declared that he dined happily on roast beef and mashed potatoes.

The first long-term survival was reported by Dollinger (63), who in 1901 removed the entire stomach of a policeman. This patient was living and well, being employed at his usual occupation at the time of the report four years and nine months after his operation. The longest survival on record is that of a woman aged thirty-nine years, who was reported living more than eight years after a total gastrectomy by Stahnke (220, 221). She was in good health except for a microcytic anemia which was treated by the administration of iron.

In the present article, we have collected all published case reports in the medical literature up to July 1, 1942, and to this series have added 20 cases in which the operation of total gastrectomy was performed by us (Table XIV). Therefore we have available for analysis in this collective review a total of 303 complete gastrectomies for tumors, of which 298 were carcinoma, 3 sarcomas, and 2 benign tumors of the stomach. A definite attempt has been made to obtain follow-up or end-result data on all patients living at the time the case reports were published. Such information has been obtained from all contributors residing in the United States and Canada. Moreover, each surgeon was asked whether or not a macrocytic type of anemia occurred at any time subsequent to the performance of the operation. Details concerning the complications of the operation and the probable cause of death were secured whenever possible. It is possible, therefore, for us to present an accurate and critical review of the past and present status of this operation in the treatment of cancer of the stomach.

TABLE I.—TOTAL GASTRECTOMY: INITIAL SYMPTOMS

Symptom	Number	Per cent
Cases for which information was given...	182	100.0
Pain	76	41.8
Epigastric fullness, pressure, satiation.	27	14.8
Anorexia	20	11.0
Nausea, vomiting	14	7.7
Dyspepsia, indigestion	13	7.1
Weakness and fatigue	9	4.9
Loss of weight	6	3.3
Ulcer syndrome	5	2.7
Belching	3	1.6
Hematemesis	3	1.6
Anemia	2	1.1
Diarrhea	1	0.6
Dysphagia	1	0.6
Constipation	1	0.6
Regurgitation	1	0.6

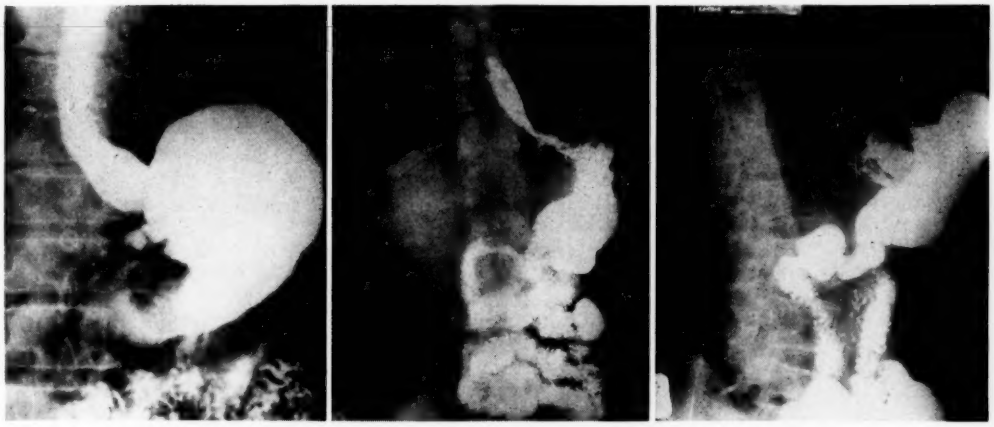
SYMPTOMATOLOGY

There is surely no significant symptom or syndrome presented by these patients suggesting an indication for total gastrectomy. The symptoms and signs produced are not pathognomonic but rather are those which commonly attend cancers of certain extent and involving various segments of the stomach. There are two symptoms encountered less frequently than one ordinarily expects in a large group of patients with cancer of the stomach, namely, dysphagia and the syndrome of peptic ulcer. Dysphagia, presumably due to involvement of the cardia, was the initial complaint in less than 1 per cent of the patients for whom symptoms were given, as compared to a frequency of 11 per cent in the Memorial Hospital series of all patients with gastric cancer. The inevitable conclusion here is that dysphagia must usually indicate the unsuitability of most cases for the operation of total gastrectomy. Of course, it does not contraindicate an attempt at transthoracic cardiectomy. The inference to be drawn from the low incidence of ulcer symptoms (2.7 per cent) in these patients is that more conservative operations than total gastrectomy are usually feasible for the ulcer-cancers of the stomach. The initial symptoms noted by 182 patients who underwent total gastrectomy are shown in the order of frequency in Table I.

The duration of symptoms from the time of the first complaint to the date of admission was related by 162 patients (Table II). The average duration was eleven and seven-tenths months, which is surprisingly shorter than the duration of symptoms (sixteen months) related by our patients who had only partial gastrectomy. For three-fourths of the patients who underwent total gastrectomy the duration was a year or less.

X-RAY AND GASTROSCOPIC EXAMINATION

Roentgen examination should always precede the introduction of the gastroscope in these



a b c

Fig. 1. Total gastrectomy for carcinoma of the cardia involving the terminal esophagus. *a*. F.B. Case 8. Roentgenogram of stomach after swallowing of barium to reveal involvement of terminal esophagus causing obstruction and dilatation. The operation was completed through the abdominal approach. *b*. F.B. Case 4. Roentgenogram of stomach made after swallowing of barium to show the filling defect in the cardia involving the terminal esophagus with dilatation of this organ. The operation was possible through the abdominal approach. *c*. L.R. Case 12. Roentgenogram of stomach after swallowing of barium to show involvement of the cardia. The total gastrectomy was done through a laparotomy incision.

patients, because it is necessary to know if the cardia is free, obstructed, or invaded. In almost every case, after a detailed x-ray study of the stomach, the surgeon is preoperatively aware that total gastrectomy may be necessary. Inasmuch as this indication may be predetermined by the x-ray findings, no surgeon should undertake a laparotomy under these conditions unless he is prepared by technical knowledge and courageous intent to perform a total gastrectomy. In our personal experience, the x-ray and gastroscopic studies were sufficiently accurate in every instance, that none of these patients herein reported had operations performed on them with the expectation or hope that a partial or subtotal gastrectomy could be accomplished.

The fluoroscopic examination and the series of examinations after the ingestion of barium may show the presence of a fungating or papillary carcinoma situated in the fundus or high on the anterior or posterior wall of the stomach or they may reveal an ulcerating cancer involving almost the entire organ with rigidity due to upward extension along the lesser curvature. The linitis-plastica variety of gastric cancer is the cause of a relatively higher proportion of total gastrectomies than are the other varieties of gastric cancer.

Invasion of the abdominal esophagus with or without obstruction should be known before the operation (Fig. 1). The degree of dilatation of the esophagus is noted. It is sometimes possible to demonstrate the extension of the cancer in the esophagus superior to the diaphragm, in which circumstance the abdominal approach should be abandoned and an attempt made to perform a transthoracic, transdiaphragmatic resection of the cardia and fundus, or even a total gastrectomy. At times the earliest indication of involvement of

TABLE II.—TOTAL GASTRECTOMY: DURATION OF SYMPTOMS

Duration	Number	Per cent
Cases for which information was given	162	100.0
3 months or less	22	13.6
4 to 6 months, inclusive	48	29.6
7 to 9 months, inclusive	20	12.3
10 to 12 months, inclusive	32	19.8
13 to 18 months, inclusive	10	6.2
19 to 24 months, inclusive	20	12.3
25 to 36 months, inclusive	4	2.5
37 to 48 months, inclusive	6	3.7

Symptoms of one year or less were reported by 75 per cent of the 162 patients.

TABLE III.—TOTAL GASTRECTOMY: TYPE OF TUMOR

Type of Tumor	Number	Per cent
Total cases	303	100.0
Malignant tumors—Total	301	99.3
Carcinoma	298	98.3
Sarcoma	3	1.0
Benign tumors—Total	2	0.7
Polyposis	1	0.3
Neurolemmoma	1	0.3

the cardia is detected on fluoroscopy either because of an unnatural delay or prolongation of the delay in the passage of barium into the stomach, which may be associated with an absence of the pendulum movement of the lower esophagus as it participates in deglutition. On the other hand, the cardiac orifice may be unusually patent and lacking in its pseudovalvular action so that the barium rushes with unnatural speed through this rigid opening. A too rapid emptying is just as significant as a too delayed emptying of the esophagus.

If the x-ray studies show the upper third or more of the stomach to be pliable and apparently uninvolved, the flexible gastroscope may be safely introduced. It is often helpful in forming an idea concerning the amount of uninvolved stomach superior to the cancer. If the lesion extends quite high and if the esophagus is uninvolved, then the flexible gastroscope should not be used, because it is introduced blindly and so may traumatize the cancer and cause hemorrhage or perforation. The rigid instrument of the Janeway or Jackson type is safer to employ under these circumstances as it is passed down the esophagus under direct visual guidance at all times. Furthermore, it is possible to obtain a biopsy through these instruments. By measurement from the upper incisor teeth, it is possible to estimate the exact location of the superior margin of the cancer.

INDICATIONS FOR TOTAL GASTRECTOMY

The indications for total gastrectomy depend not only on the condition of the patient and the location and extent of the gastric cancer, but also on the viewpoint of the operator. Graham (87) has expressed this attitude well in the following quotation: "The enthusiasm which the individual surgeon displays for this operative procedure will depend largely on his philosophy of life. If such philosophy demands that all efforts be used to prolong life, even though the effort be accompanied by grave immediate risk, and though the patient ultimately must die from carcinoma, providing he lives long enough, then such a surgeon must be an advocate of total gastrectomy."

The conservative surgeon can always present several logical reasons for not attempting an operation of this magnitude. The high immediate mortality, the numerous and distressing postoperative complications, the short survival periods of those patients who recover from the operation due to the high incidence of recurrence of the cancer or the late appearance of distant metastases, the consequent low rate of curability, and the occasional unpleasant dietary and digestive discomfort and the limitations during the months of life salvaged by this procedure present a gloomy picture indeed. The same handicaps, however, attended the early history of operative procedures for cancer in other organs, and it is reasonable to believe, therefore, that improvement in operative mortality and end-results will follow the more general employment of this operation.

There is only one proper indication for total gastrectomy, namely, the presence of a malignant tumor in the stomach which cannot be safely removed by partial gastrectomy. At times, technical problems arise during the course of any operation on the stomach which demand a more radical technique than was at first anticipated. Certain benign diseases of the stomach may simulate cancer or, because of their location, be amenable only to total extirpation of this organ. Many of the total gastrectomies reported in the literature were not anticipated prior to laparotomy and were done more or less in desperation when the surgeon found in the course of the operation that the planned subtotal resection could not guarantee complete removal of the involved segment of the stomach. It is important, therefore, for all surgeons who employ partial gastric resection for cancer, to be familiar with the operative technique for total gastrectomy, because it may be necessary to complete an operation by this procedure.

The many difficulties and hazards which exist both during and after the operation would seem to contraindicate its use for benign gastric tumors with the rare exceptions of huge ulcerating leiomyomas and diffuse polyposis *en nappe*, or polypous gastritis, in which latter condition the natural termination is death from carcinoma. The occurrence of dangerous and repeated hemorrhages from these tumors may influence the surgeon in making such a decision.

Many gastric surgeons have no hesitancy in performing partial gastrectomy for cancer in the presence of some small nodules of metastatic cancer in the liver, believing that resection offers better palliation than any short-circuiting operation. We agree with this principle but do not advise its adoption in the case of total gastrectomy. The risks and handicaps of total gastrectomy are too great to permit its use as a known palliative operation, although in the subsequent life of the patient it may actually serve this purpose. We may say that the purpose of the operation is curative, although the result may be only palliative.

The number of patients for whom this operation is indicated is naturally quite limited, since it

necessitates, as a rule, the presence of an extensive cancer in the stomach and the apparent absence of metastases beyond the perigastric lymph nodes. Autopsy findings on those dead of gastric carcinoma have established the fact that over 20 per cent of the individuals are free of any evidence of distant metastases at the time of death from the disease and have a type of cancer which to the very end is still confined to the stomach, or to the stomach and immediately adjacent nodes. This finding has been constant throughout the entire history of gastric cancer whenever 100 or more autopsy examinations have been conducted. It was noted by Welch in 1884 in his classical survey, and the same finding has been repeatedly emphasized by pathologists in all periods since that time. Surgeons and clinicians are wont, at times, to explain unusually low rates of operability and resectability by the assumption that in their particular locality an unusual number of patients are inoperable when first seen. Although this may be true in part, the autopsy finding that 1 cancer of every 4 or 5 remains confined to the stomach or stomach and juxtagastric nodes to the time of death robs such argument of merit. "Resectable gastric tumors found only at postmortem examination are referred to as lost opportunities for cure and a sizable percentage of these is always to be considered a regrettable discovery. From available statistics it appears safe to assert that no institution in which operability rates fall below 40 to 60 percent or resections fall below 20 percent of all patients observed with the disease has effectively discovered its full quota of resectable carcinomas of the stomach." (143)

It should not be inferred from these statements that all 20 per cent of the patients who died with the cancer still confined to the stomach and perigastric nodes are suitable for gastrectomy, because other contraindications for operation may exist, such as extreme old age, debility, and cachexia. Old age alone is not an unsurmountable handicap, as this collective review will show. In 263 cases in which the age of the patients was given, the range extended from twenty-seven to seventy-three years, with the average age at the time of total gastrectomy fifty-one and six tenths years. The sex of the patients undergoing total gastrectomy was: males—56.5 per cent, and females—43.5 percent. The average age of 19 of the authors' patients was fifty-five and five-tenths years, with a sex distribution of 14 males and 6 females.

Perhaps the most influential factors in deciding to perform total gastrectomy instead of partial gastrectomy after the abdomen is open are the location and extent of the cancer. For example, the primary growth may involve the distal segment only, but the metastases may extend so high and be so adherent to the lesser curvature near the cardia or to the hilum of the spleen, that total extirpation of the stomach is the only possible method of removing all of the demonstrable cancer. From a study of Table IV, it will be seen that there are three gross varieties of gastric cancer which lend themselves to the operation of total gastrectomy. One is the rare type of multiple primary gastric cancer of which there were 4 cases. The most common type is the usual gastric cancer which begins as a localized tumor near the pylorus or cardia and in time extends to involve the major portion of the stomach. Linitis plastica or the leather-bottle type of stomach represents the ideal case for total gastrectomy; somewhat similar in extent but not so favorable in prognosis is the diffuse gastric cancer without segmental localization.

TABLE IV.—TOTAL GASTRECTOMY: LOCATION OF THE CARCINOMA

Location	Number	Per cent
Cases for which information was given...	144	100.0
Entire stomach	24	16.7
Extensive involvement	27	18.8
Proximal third	24	16.7
Proximal one-half or two-thirds	10	6.9
Pars media and fundus	7	4.2
Curvatures and walls	37	25.7
Distal third	8	5.6
Distal one-half or two-thirds	3	2.1
Two primary tumors in the stomach	4	2.8

The location of the two primary tumors is as follows:
2 cases—cardia and pylorus
1 case —cardia and posterior wall
1 case —pylorus and fundus

If one compares the usual operations for gastric cancer with the well planned radical mastectomy for cancer of the breast, the inadequacy of the procedures is at once apparent. If we could banish the thought of all operative dangers and postoperative complications, in theory we could assert that total gastrectomy is a far more logical procedure than partial or even subtotal gastrectomy. Its occasional employment extends the scope of treatment for gastric cancer and adds a little more to our ability to save human life.

ANESTHESIA

The lowered mortality rate in recent total resections of the stomach is probably due, not so much to technical advances in gastric surgery as to improvement in the technique of anesthesia. Nupercaine spinal anesthesia (from 8 to 20 cc. of 1: 1,500 solution) is consistently good for the three-hour period that is frequently necessary for

this operation. Pantocain, in doses of 20 mgm., added to hypertonic glucose solution has proved to be a most satisfactory spinal anesthetic; this hyperbaric solution can be so controlled that the level of anesthesia is readily determined by the anesthetist. Continuous spinal anesthesia by the method of Lemmon (141) is the procedure used by the authors. It may be deepened at every need, e.g., when traction is exerted on the esophagus and when the abdominal wound is closed. Local infiltration of the abdominal wall by procaine supplemented by splanchnic anesthesia is preferred by De Amesti (59, 60).

In our experience, the adoption and routine use of high spinal anesthesia have not only facilitated the performance of the operation because of the complete relaxation of the abdominal wall, but also have decreased the degree of shock. Supplementary sodium pentothal (intravenously) in small doses may be employed for excitable patients.

OPERATIVE TECHNIQUE

Modern surgeons who have recently evinced great interest in this operation have rediscovered some of the cardinal and fundamental principles propounded by the earlier surgeons in their occasional and desultory attempts at total gastrectomy. Although we deplore the trend to apply eponyms to these procedures, we consider it only just to give proper credit to their origin. For example, Moynihan (166) in 1903 sutured the jejunum to the diaphragm for suspension; Hans Brun in 1912 first removed the spleen at the time of total gastrectomy; and Schmieden (209) in 1933 developed diaphragmatic flaps to cover the line of anastomosis.

CHOICE OF THE TRANSABDOMINAL OR THE TRANSTHORACIC ROUTES

Although the great majority of total gastrectomies have been performed through laparotomies, the possibility of doing the procedure by means of a transthoracic, transdiaphragmatic exposure should be borne in mind. This has been successfully employed by Churchill (42). The general principles of this operation have been well developed and experience has been gained for carcinomas of the cardia which invade the esophagus. The anastomosis after resection is usually an intrathoracic esophagogastrostomy with the distal segment of stomach. The exceptionally good exposure afforded through the chest and split diaphragm will unquestionably influence surgeons to employ this route for total gastrectomy. In 1 instance we were able to construct an intrathoracic esophagojejunostomy following a transdiaphragmatic resection of an extensive gastric cancer; this patient convalesced without complications and now is in good health six months after the date of operation. This case is not included in the present report because the pyloric canal was left intact; it is mentioned to illustrate the feasibility of transthoracic total gastrectomy.

Abdominal incision. The site for the initial incision is usually to the left of the midline and may be paramedian with lateral retraction of the rectus abdominis muscle, or it may be a split-muscle incision. Although the duodenal stump is not quite so well exposed as through an incision on the right side, this slight disadvantage is more than compensated for by avoidance of the falciform ligament and better exposure of the cardia and fundus. The incision extends from the costal margin to a point at least 2 fingerbreadths below the level of the umbilicus. Ninety-five per cent of all total gastrectomies can be done through such a vertical incision, but in some exceptional cases an oblique incision running parallel to the left costal margin, after the method of Marwedel, will afford a more complete exposure of the cardia and fundus. In 2 instances we used a modification of the Baudet and Navarro technique by temporary or permanent resection of the left costochondral arch. The incision extends from the left sternal border in the region of the sixth left costal cartilage and is carried downward until it runs parallel to and 1.5 cm. below the costal arch. The incision must be below the costal arch in order to leave sufficient musculature above for suture and closure, and it extends laterally as far as the anterior axillary line. The incision is made through the skin, fascia, and muscles down to the plane of the costal cartilages and intercostal muscles. The last 2 ribs of the costochondral arch are severed at a distance of 3 or 4 cm. from the border of the sternum. The last 2 or 3 ribs are severed laterally in the anterior axillary line. Elevation of this flap upward readily exposes the fundus, cardia, abdominal segment of the esophagus, and left lobe of the liver. Self-retaining wound retractors may be used if the surgeon so desires. The costochondral flap may be replaced and sutured in position or it may be completely excised with no deleterious results. This wound is subjected to unusually great stress and strain because of respiratory movements.

Two-stage total gastrectomy. Wangensteen (253) has suggested the possibility of performing this operation in two stages in order to obviate retraction of the esophagus and to avoid contamination. He attempted this technique in 1 instance. The procedure is described as follows:

At the first operation the adjacent limbs of a jejunal loop were drawn through the transverse mesocolon and behind the stomach and were sutured to the diaphragm and the mobilized subdiaphragmatic esophagus. An enteroanastomosis was made between the two limbs of the jejunal loop near the root of the mesentery. The continuity of the gastrointestinal canal was not disturbed. At the second operation, the stomach was removed and the esophagojejunal anastomosis was completed.

Abdominal exploration and determination of resectability. On opening the peritoneal cavity, the surgeon should first be assured of the absence of tangible evidence of metastases involving the liver, rectovesical pouch, and base of the mesentery of the transverse colon and small intestines. The visceral and parietal peritoneum is inspected for signs of carcinomatosis. The location and extent of the cancer is determined and the general mobility of the stomach is tested. Six cardinal regions of importance are examined before the resection is started.

1. With a forefinger in the foramen of Winslow the hepatoduodenal ligament is carefully palpated for evidence of extension or infiltration of the cancer upward toward the portal fissure.

2. After the tenuous gastrohepatic ligament is broken through, the left gastropancreatic fold and vessels are palpated to ascertain if lymphatic extension of the cancer is progressing toward the celiac axis.

3. The abdominal esophagus is found and felt to determine, if possible, the mobility of this organ, the palpable superior limits of the cancer, and the length of esophagus available for anastomosis.

4. The spleen is visualized as well as the gastrolienal ligament in order to see if they are free of cancerous infiltration and to enable the surgeon to decide whether to remove the spleen as a part of the operation or leave it. It is better to make this decision in advance than to wait until grave and accidental hemorrhage from the splenic vessels or hilum of the spleen forces the issue.

5. The posterior wall of the stomach is inspected through a rent made in the gastrocolic ligament; the most important determination here is the extent and character of adhesions to the peripancreatic tissues, if such are present.

6. The superior surface of the transverse mesocolon is examined to ascertain its freedom from invasion by the cancer, especially in the region of the middle colic artery.

If the slightest doubt exists as to the resectability of the cancer, the operator should proceed to mobilize the stomach as the initial maneuver. Once the duodenum is transected there is no other recourse but to complete the operation even though the futility of it may become apparent later. If it is obviously possible to do the total gastrectomy, then the duodenum may be severed at once in the customary manner. Otherwise the stomach is first freed of its attachments to the liver, transverse colon, spleen, et cetera; severance of three or the four major vascular trunks to the stomach will not interfere with the remarkable viability of this organ.

In a recent case of extensive cancer occurring in the presence of an old gastroenterostomy in an aged debilitated patient, the resectability of the stomach was in question because of the great technical difficulties anticipated and the desperate condition of the subject. During the preliminary mobilization of the stomach, the right gastric artery, the right and left gastroepiploic arteries, and the vasa brevia or short gastric branches from the splenic artery were severed and ligated. Notwithstanding all efforts to prevent it, the patient had a progressive cardiovascular collapse which necessitated an immediate termination of the operation at this stage, when the stomach was completely free except for its continuity with the esophagus and duodenum; and the left gastropancreatic fold with its contained left gastric artery, then the sole blood supply of the stomach, was preserved. This patient experienced an uneventful convalescence. The case report is cited to emphasize the importance of determining the resectability of the stomach before proceeding to the irreversible step of transecting the duodenum.

Scope of the excision. The well planned and radical operation of total gastrectomy is not simply a complete removal of the stomach itself; it is designed to include a dissection en masse of the perigastric tissues containing the lymphatic drainage basins of the cancer. In this respect it resembles the plan and scope of other established operations for cancer, such as radical mastectomy, vulvectomy with bilateral groin dissection, excision of the lower lip with bilateral suprahyoid dissection and abdominoperineal rectal resection, in which operations the primary cancer, the entire organ containing the cancer and the lymph nodes and lymphatic pathways draining these organs are removed en masse, i.e., in continuity. Along with the stomach are removed the nodes of the lesser curvature, the nodes of the left gastropancreatic fold, the right gastroepiploic nodes, the infrapyloric nodes, the retropyloric node, and, in some cases, the splenic nodes. If the lymph nodes along the splenic pedicle are involved, the

spleen is removed with the stomach. The first combined splenectomy and total gastrectomy was done in the case of a patient operated on by Hans Bruns in 1912 and reported by Kobelt (126). Schwarz (215) in 1925 used this technique successfully in 2 patients and numerous other surgeons including Turner (231), Allen (6, 7), Ransom (189), Jennings (155), and Lahey (138) have called attention to the occasional necessity of adding splenectomy to total gastrectomy. Some surgeons assert that the coincident removal of the spleen greatly simplifies the operative task. Graham (89), however, relates the accident of a cerebral thrombus which occurred on the tenth day following a combined splenectomy and total gastrectomy and attributed the vascular accident to an increase in platelets. In his opinion, if splenectomy becomes necessary because of accidental injury of the splenic blood supply or because of the site of the growth, the patient should be given heparin postoperatively. The great omentum is always removed with the stomach; this step does not add to the difficulties or time of the operation, in fact it considerably lessens the number of ligatures necessary along the greater curvature. The avascular attachment of the great omentum to the transverse colon and its reflection on the superior surface of the transverse mesocolon are freed by the relatively bloodless procedure of harp and blunt dissection. The extent of this removal and its relation to the viscera are shown in an accompanying illustration. By the inclusion of the great omentum in this excision, the lymphatics and nodes of the greater curvature are completely and safely removed. Furthermore, if an antecolic jejunal loop is to be used for the anastomosis, the omentum, when present, adds an additional weight and bulk to be suspended in the sling of the intestinal loop with unwanted traction on the anastomosis.

Esophagoduodenostomy versus esophagojejunostomy. In the discussion on the operative mortality of total gastrectomy, attention is called to the fact that the esophagojejunal anastomosis has gradually supplanted esophagoduodenostomy as the operator's choice (Fig. 2). The reasons for the unpopularity of esophagoduodenostomy are the technical difficulties of accomplishing this anastomosis, the almost universal unsuitability of the method, and the constantly high operative mortality. The procedure of gastroduodenostomy is usually done only in the rare instances when the abdominal esophagus is unusually long and placed low on the lesser curvature of the stomach and the duodenum is exceptionally mobile. To effect this union the duodenum is extensively mobilized by cutting a bloodless fold of peritoneum passing from the second portion of the duodenum to the posterior parietal wall of the abdomen. This incision is made parallel to and just beyond the convex curvature of the duodenum. The duodenum is then freed by blunt dissection from its posterior attachments, which restores its embryological position as a midline organ with a posterior mesentery (Kocher, 129) mobilization of the duodenum). This resulting wide mobility of the bowel sometimes makes possible its end-to-end anastomosis to the abdominal esophagus.

Closure of the duodenum. Transection and closure of the duodenum are done when the operator is assured that the gastrectomy can be accomplished and that the jejunum should be used for the later anastomosis. The duodenal stump may be closed by any of the well-known "aseptic" procedures, by means of the Parker-Kerr basting stitch, the Furniss clamp and needle, or the De Petz metal clips, reinforced by additional mattress sutures (Lembert, Gould, Halsted) to secure wide peritoneal approximation. The suture line is then reinforced by tucking it under a fold of the peripancreatic fascia. If the duodenum is abnormally short or if it is necessary to sacrifice much of it, the "open" technique has certain advantages, namely, accurate hemostasis, lack of devitalization of the remaining bowel, and ease of closure due to the absence of any cumbersome instruments. Leakage from the open duodenal stump is minimal and safe if proper precaution is observed and the open end is quickly closed by an initial running Connell suture with the usual reinforcements.

Mobilization of the cardiac end of the stomach. The left triangular ligament of the liver is attached by one border to the superior surface of the left lobe near its posterior border, and by the other to the diaphragm for a distance of several inches. Its attachment to the diaphragm lies nearly altogether to the left of the esophageal hiatus and about ¾ in. anterior to the plane of this opening. As this ligament is practically avascular, it may be safely severed with the scissors, after which the released left hepatic lobe can be folded toward the right, covered with a moist laparotomy pad and held out of the operative field by gentle retraction. This procedure usually affords a better exposure of the terminal esophagus and cardiac orifice. Crescent-shaped anterior and posterior flaps are prepared from the diaphragm and esophagus as they are to be used later for suturing to the wall of the jejunum below the anastomosis. These peritoneal flaps will not only offer additional support

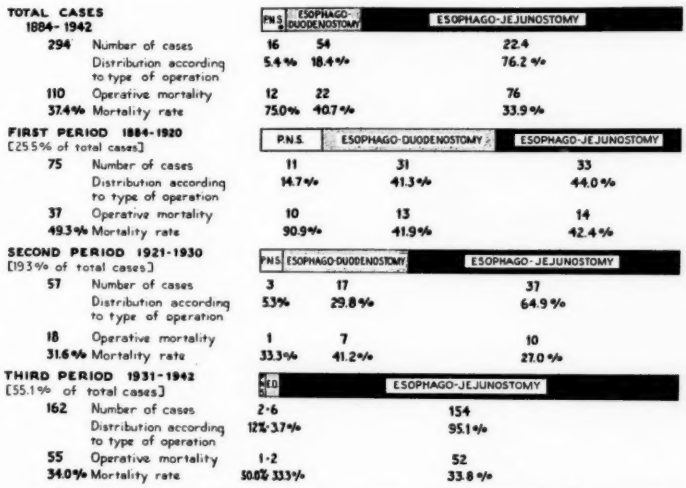


Fig. 2. Total gastrectomy for carcinoma of the stomach. Distribution according to periods of time and types of operative procedure, with the operative mortality for each period and type of anastomosis.

At the left of the chart is shown the distribution according to periods, with the operative mortality for each. For the total of 294 cases, the operative mortality rate was 37.4 per cent, based on 110 operative deaths.

Prior to 1921 there were 75 total gastrectomies, representing 23.5 per cent of the total. For these, the mortality rate was 49.3 per cent (37 operative deaths). In the second period, 1921 to 1930, the number of operations dropped slightly to 57 cases, 19.4 per cent of the total. The operative mortality was 31.6 per cent. In the current period, from 1931 to date, more than half of the total gastrectomies were performed, 162 cases, or 55.1 per cent, with a mortality rate of 34.0 per cent.

The bars indicate the distribution according to operative procedure, with the top bar for the total cases. Here esophagojejunal anastomosis represents 76.2 per cent of all total gastrectomies. In the other bars, the trend toward this procedure as the operation of choice is readily seen: in the period prior to 1921, 44.0 per cent; from 1921–1930, 64.9 per cent; and from 1930 to date, 95.1 per cent.

Operative mortality can be compared according to type of operation and period. For the esophagojejunal type of anastomosis the mortality rate was lowest in the period from 1921 to 1930—27.0 per cent, based on 37 cases. In the last period the number of cases was increased by over a hundred, with a slight increase in the mortality rate, 33.8 per cent.

The allocation into periods is done for the most part on the basis of the year of operation. In the cases in which this is not given, the year of publication is the basis, with the exception made in cases reported at the beginning of a period with the end-result indicating that the operation must have been performed in the preceding period.

There is a slight discrepancy in the figures on this chart and those presented in Table V. Four additional cases recently operated upon by the authors are included in Table V. Since the changes influenced the results to such a slight degree, the chart was not redrawn.

*P.N.S. Procedure not specified.

in bearing the weight of the jejunal loop but will also aid in sealing the anastomosis and lessening the hazard of leakage. In these maneuvers, some care should be exercised in preserving the arteries and small veins on the esophagus. The esophagus can be mobilized and drawn downward into the abdomen for an additional 2 to 5 cm. by gentle blunt dissection with the finger tip. Because of the fixation of the esophagus by its passage through the diaphragm and the close connection between the stomach and the diaphragm near the cardia where the peritoneum is absent, this is the most fixed part of the whole organ. The fixity of the anastomosis becomes even greater and more secure by supplementary anchorage of the jejunum to the diaphragm after the anastomosis

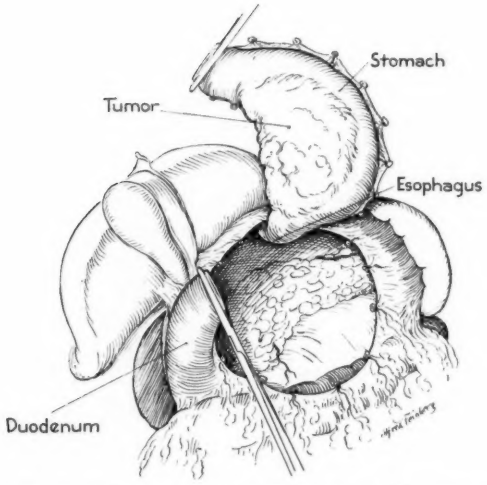


Fig. 3. Technique of total gastrectomy. Mobilization of stomach. The initial step for esophagoduodenostomy. Incision along the lateral duodenal fold to facilitate rotation and extension of the duodenum.

has been completed. We have never crushed the phrenic nerve to secure temporary paralysis of the left side of the diaphragm in the performance of total gastrectomy through an abdominal incision, because the danger of pulmonary complications is greater than any hazard to the suture line of the anastomosis through free, diaphragmatic movements. Complete mobilization of the cardia greatly facilitates the subsequent steps in the operation. The cardiac opening is situated more on the anterior than the posterior surface of the

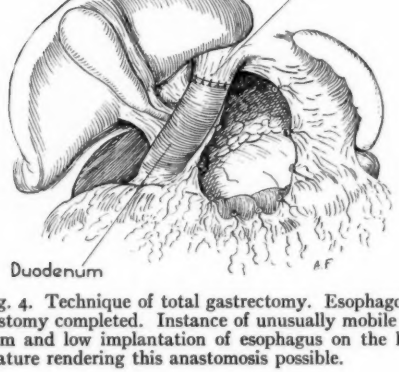


Fig. 4. Technique of total gastrectomy. Esophagoduodenostomy completed. Instance of unusually mobile duodenum and low implantation of esophagus on the lesser curvature rendering this anastomosis possible.

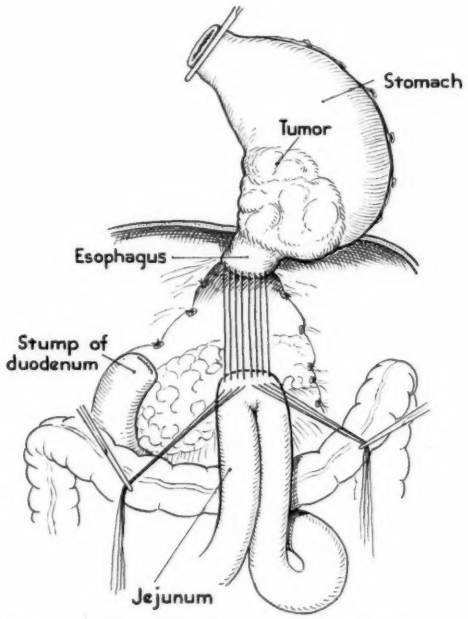


Fig. 5. Technique of total gastrectomy. Initial step in esophagojejunostomy. Placement of interrupted untied mattress sutures at a distance between jejunum and posterior wall of esophagus. The jejunum is then permitted to slide up along the sutures into its proper position after which the sutures are tied.

stomach which is an additional handicap, inasmuch as the first row of sutures for the esophagojejunostomy is placed on the posterior esophageal wall.

Technique of esophagojejunostomy. The surgeon should make a decision at this time as to whether the jejunal loop shall be brought anterior or posterior to the transverse colon; the choice of the retrocolic or antecolic position depends upon the particular case at hand, although the latter technique apparently has the wider application. If the jejunal mesentery is unusually short, it may be preferable to introduce a jejunal loop through an avascular rent in the transverse mesocolon in order to lessen subsequent traction on the line of anastomosis. Whenever the retrocolic position of the jejunal loop is chosen the stoma in the mesocolon should be lightly sutured around the ascending and descending jejunal limbs in order to prevent possible herniation of the small intestine and consequent intestinal obstruction. In those few instances in which we have employed the retrocolic anastomosis, the supplementary

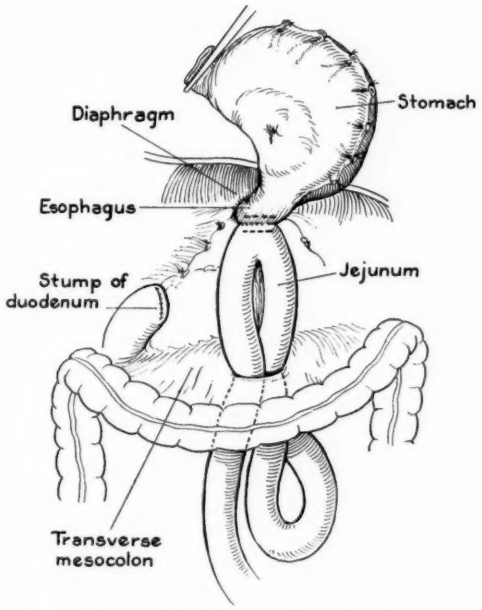


Fig. 6. Technique of total gastrectomy. Second step in esophagojejunostomy. The first posterior layer of sutures has been inserted. The line of incision through the esophagus and jejunum is shown.

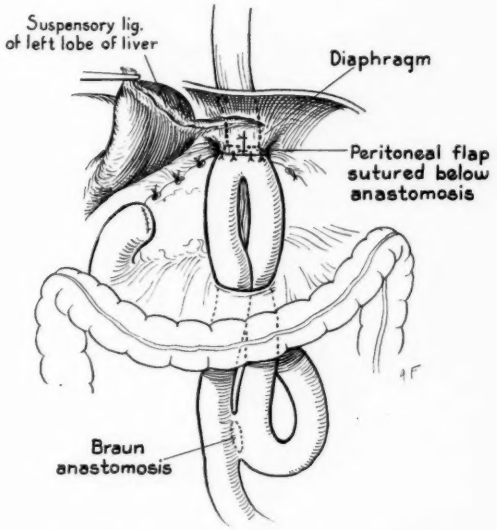


Fig. 7. Technique of total gastrectomy. The esophagojejunal anastomosis has been completed. The diaphragmatic peritoneal flap has been sutured to the jejunum below the anastomosis. The displacement of the left lobe of the liver is illustrated.

enteroenterostomy between the ascending and descending jejunal limbs has been constructed below the transverse mesocolon, which afforded the most direct route for the passage of bile and pancreatic juice to the distal jejunal limb. Whenever the jejunal loop is brought anterior to the transverse colon for anastomosis to the esophagus, a site is selected from 15 to 18 in. from the ligament of Treitz. This loop of intestine should not be too redundant, nor should it be so tight as to pull downward on the anastomosis, which it may do if it is constructed so as to create a hammock rest for a heavy transverse colon. The dangers of this hazard can be avoided by three procedures previously mentioned, namely, (1) the employment of a sufficiently long loop of jejunum, (2) the routine removal of the great omentum with the stomach, and (3) the anchorage of the jejunum to the diaphragm. After the transection of the duodenum and the complete mobilization of the stomach, the organ itself with its contained cancer may be used for traction on the esophagus by the method of Moynihan (169), in which it is pulled up firmly over the left costal margin. The stomach is first enveloped in a sterile towel, or laparotomy pad, in order that the operator's hands will not come in contact with the carcinomatous segment of the stomach. The stomach should be empty of fluid at the time it is bent or retracted upward over the left costal margin; failure to observe this precautionary measure may result in a sudden flooding of the esophagus, trachea, and lungs with retained gastric contents resulting in temporary asphyxia and later atelectasis and pneumonia. One of three procedures may be used to avoid this accident, namely, (1) the presence of a residual Levine tube through which the anesthetist maintains constant suction, (2) the preliminary insertion of an aspirating trocar through a purse-string suture of an opening made in an uninvolved segment of the stomach, and (3) the cautious placement of a right-angled clamp across the cardia distal to the proposed line of anastomosis. The esophagus itself should not be clamped because the structure is too delicate and fragile to tolerate such trauma. It is preferable never to clamp the esophagus and the jejunum, which means that some form of open anastomosis is usually employed.

The majority of surgeons since the time of Moynihan (166) (1903) now elevate the jejunal loop and suture it to the diaphragm posterior to

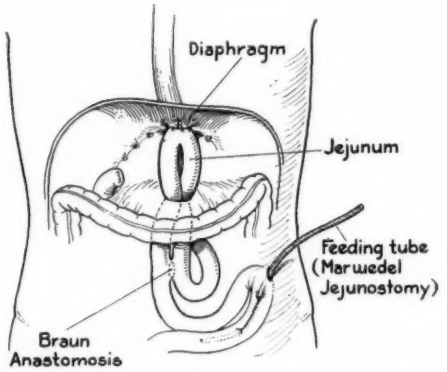


Fig. 8. Technique of total gastrectomy. A retrocolic type of anastomosis with a lateral supplementary entero-enterostomy. A Marwedel jejunostomy has been constructed for feeding purposes. In lieu of this a Levine tube may be inserted through the nose down the esophagus and distal limb of the jejunum inferior to the enteroenterostomy.

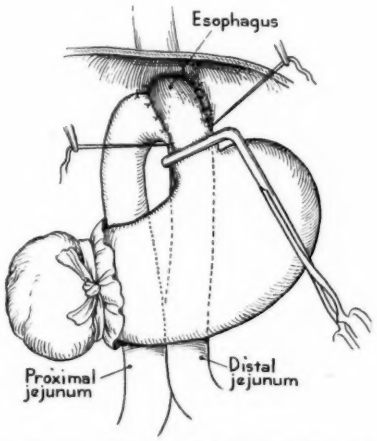


Fig. 9. Roscoe Graham technique of total gastrectomy. The infradiaphragmatic portion of the esophagus is placed on the anterior surface of the distal limb of the jejunum and fastened there by means of interrupted silk sutures.

the abdominal esophagus. This most essential step in affording security to the delicate anastomosis may be done immediately or may be deferred until after the anastomosis is complete, as we prefer to do. If the carcinoma is situated high on the posterior wall of the stomach its protuberance may so obscure the vision of the surgeon that the introduction of a large jejunal segment into the operative field may greatly handicap the facility with which the anastomosis is accomplished. We have avoided this difficulty by the substitution of a procedure which is outlined. By this technique long interrupted mattress sutures are placed through the jejunum and the posterior wall of the esophagus, without these organs being in close approximation. After the sutures are all in place the jejunum is then gently pushed along the sutures, up which it slides until it is in contact with the esophagus at its proper location. The interrupted posterior layer of mattress sutures are then tied individually. This simple and original variation in technique overcomes one of the greatest difficulties in the operation, namely, the placement of the initial posterior layer of sutures between the esophagus and the jejunum.

Certain surgeons, Jennings (115) and others, have advocated ligature of the esophagus and burial of the closed esophageal stump into the jejunum; they depend on the later restoration of continuity of the lumen by digestion of the occluding catgut ligature. In the majority of cases, however, it is more feasible to effect a layer closure of the anastomosis. The primary posterior layer is closed with interrupted silk mattress sutures. The second and inner layer is closed with fine chromicized catgut by means of atraumatic needles. The jejunum and esophagus are incised and opened parallel to the suture lines, during which procedure the assistant maintains constant suction to avoid contamination of the operative field. The surrounding region is carefully protected by laparotomy pads. As soon as the esophagus is incised an aspiration tube is inserted to remove all accessible esophageal secretion. The entire posterior wall of the esophagus should not be completely severed at this time because this organ is so fragile that it may tear obliquely or vertically upward because of the traction constantly exerted on it. On this account the smallest opening possible is initially made, and through this a posterior inner layer of chromicized catgut sutures is taken with the jejunum. As this continuous but interlocking suture progresses transversely, the esophagus is gradually incised wider in its transverse direction. Only by this means can the operator be assured of the correct dimensions of the stoma under construction and retain the integrity of the remainder of the esophagus.

After the second posterior layer of sutures has been properly placed the anterior wall of the esophagus may be completely transected by which procedure the stomach is entirely removed from the operative field. The catgut sutures of the inner posterior row are locked and tied in order to avoid a purse-string effect with subsequent contraction and stricture formation. This layer is

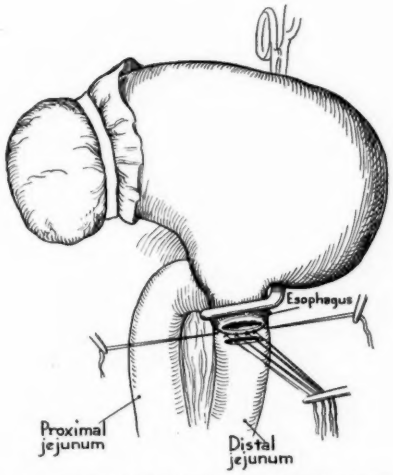


Fig. 10. Roscoe Graham technique of total gastrectomy. The stomach remains attached to the esophagus while interrupted sutures unite the posterior wall of the esophagus to the anterior wall of the distal limb of the jejunum. The two lateral sutures are held in hemostats and act as stay sutures while the esophagojejunal anastomosis is completed.

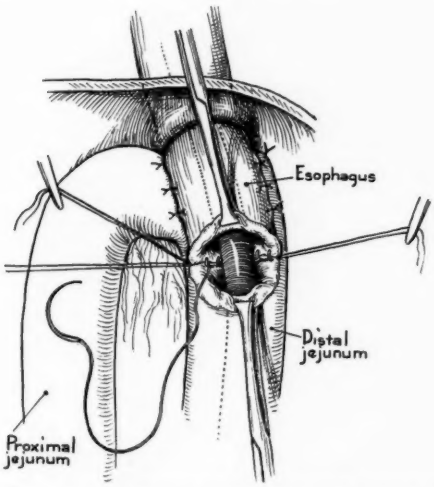


Fig. 11. Roscoe Graham technique of total gastrectomy. The stomach has been removed and the mucous membranes of the stomach and jejunum are being united. The Levine tube is passed into the jejunum well beyond the anastomosis.

now continued anteriorly as a running Connell suture. It is supplemented by interrupted silk mattress sutures as the final anterior layer.

If the jejunum has not been anchored to the diaphragm, this should now be done on each side of the anastomosis, in order to relieve the weight of the bowel from the suture line. The previously constructed diaphragmatic peritoneal flaps are brought down and sutured to the jejunum over the line of anastomosis, which effectively seals it and provides an extra safeguard against leakage.

Indications for jejunojejunal anastomosis. Lahey (133, 134, 137) has advocated the abandonment of the lateral anastomosis of the ascending and descending jejunal limbs. In his opinion the use of a long proximal loop without the supplementary enteroenterostomy provides a substitute pouch where digestion can take place before the ingesta is hurried along the small intestine. We prefer the routine employment of a lateral communication between the ascending and descending jejunal limbs for several reasons, namely, (1) without such an anastomosis there is a very great back pressure against the duodenal stump; (2) the food which is swallowed may enter the proximal jejunal limb and remain there for many hours, or even days, which would cause considerable distress; (3) the bile and pancreatic juice secreted into the duodenum in the absence of a Braun lateral anastomosis will necessarily have to be regurgitated into the esophagus before it enters the descending or distal jejunum. With the presence of the enteroenterostomy the bile and pancreatic juices can pass directly into the distal jejunum through this short circuit, as well as any food which enters the proximal limb.

Feeding through oral intubation or by supplementary jejunostomy. Although a properly constructed esophagojejunal anastomosis may support graduated liquid feedings by mouth, it is the authors' opinion that the wisest procedure is to place the anastomosis completely at rest for the first eight or ten postoperative days. This can be effected by one of two procedures, either the passage of a Levine tube through the naris and postnasal space down the esophagus, through the esophagojejunal anastomosis and down the distal jejunal limb well below the enteroenterostomy, or by the construction of a supplementary jejunostomy, usually of the Marwedel type, which employs the jejunum distal to the lateral anastomosis. The Levine tube is usually passed by the anesthetist after the anastomosis has been completed and before the laparotomy wound is closed. At the same time the surgeon can easily guide the tip of the Levine tube in the proper direction and for the proper length. The very great advantages of these methods of tube feedings are obvious. The patient may be given a sustaining diet, rich in protein and vitamins, to overcome

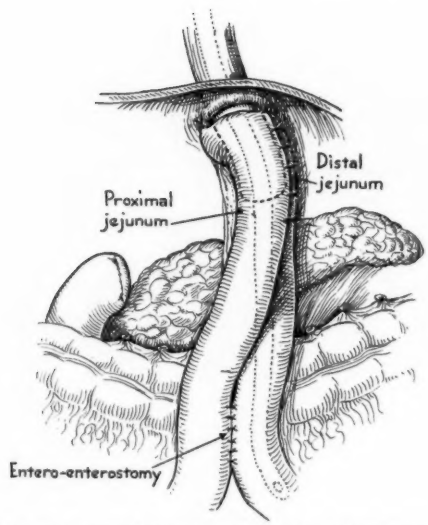


Fig. 12. Roscoe Graham technique of total gastrectomy. With the anastomosis completed the proximal jejunum is folded over the esophagus and the site of anastomosis and fixed to the left border of the distal jejunum. A supplementary enteroenterostomy is then constructed between the ascending and descending jejunal limbs.

the hypoproteinemia which is so constantly present. A high caloric diet may be given immediately without fear of consequences as far as the integrity of the suture line is concerned. It is the most satisfactory means of overcoming the ill effects of hypoproteinemia, impaired liver function, delayed wound healing, and all the other evil consequences of the metabolic disturbances which accompany gastric cancer and particularly the postoperative state after total gastrectomy.

Roscoe Graham technique of total gastrectomy. The following variation in the technique of anastomosis has been advocated by Graham (87, 88). The jejunum is brought up in the usual fashion in front of the transverse colon to be fixed to the diaphragm. When the jejunum is firmly anchored to the diaphragm, the infradiaphragmatic portion of the esophagus is then fixed by means of interrupted sutures to the anterior surface of the distal limb of the jejunum. The most distal suture on each side is held in a hemostat to act as a guide suture. The esophagus is divided and the jejunum is opened, and after the posterior layer of the anastomotic suture has been completed the Levine tube is passed down into the distal jejunum. When the anterior layer of the anastomosis is finished, the proximal jejunal loop is rolled laterally across the esophagus and sutured to the left lateral margin of the distal limb of the jejunum. This completely surrounds the infradiaphragmatic portion of the esophagus with the jejunal loops and firmly covers and supports the end-to-side jejunoesophageal anastomosis. This maneuver completely obstructs the proximal

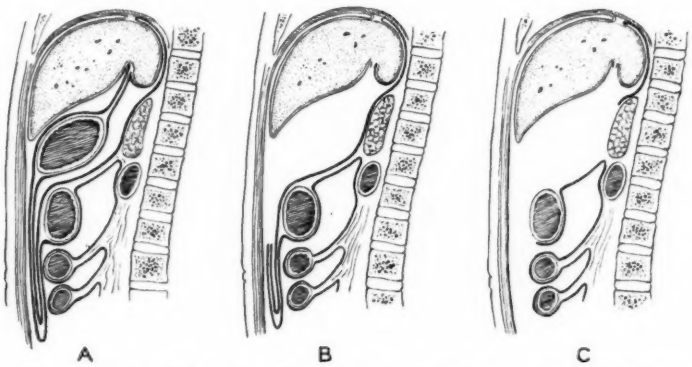


Fig. 13. (After Ogilvie.) *A*. Sagittal section through upper abdomen to show omental relations of stomach and transverse colon. *B*. The result of gastrectomy with the great omentum left intact. The gastrohepatic ligament and the gastrocolic ligament had been removed with the stomach. The great omentum and the superior surface of the transverse mesocolon remain untouched. *C*. The proper state after total gastrectomy in which the stomach, the gastrohepatic ligament, the gastrocolic ligament, the great omentum and the superior surface of the transverse mesocolon and posterior surface of the lesser omental bursa have been removed with the specimen. This represents the complete radical procedure indicated in all cases of total gastrectomy.

Fig. 14. (Courtesy of Professor Felix De Amesti.) Esophagojejunal junction seen at autopsy six months after total gastrectomy. The dimensions of the anastomosis are well shown. The compensatory dilatation of the jejunum after six months' service as a substitute pouch for the stomach can be readily seen.

jejunal loop and therefore an enteroenterostomy is carried out between the proximal and distal jejunal limbs.

WOUND CLOSURE

At the completion of the operation it has been our practice recently to dust from 5 to 10 gm. of sulfathiazole in the left subdiaphragmatic space. We routinely place two Penrose cigarette drains down to each side of the anastomosis. These drains are inserted, not because of contamination at the time of operation but because of the hazard of late leakage through the anastomosis. The most dangerous time for this leakage to occur is from the sixth to the eighth postoperative day; on this account the drains are left *in situ* for from eight to ten days before being withdrawn. By that time adhesions are so constructed that if leakage does occur the secretions come out through the abdominal wound where they may be aspirated without danger of peritonitis. The wisdom of this procedure seems to be justified in our practice because in 4 of our 20 patients such leakage did occur, but did not result fatally. The wound is closed in layers with interrupted black silk sutures supplemented by through-and-through sutures of fine wire or alloy. A transfusion of citrated blood is constantly given during the course of the operation.

Fig. 15. (Courtesy of Professor Felix De Amesti.) Example of esophagojejunostomy following total gastrectomy without a supplementary enteroenterostomy. The barium ingesta has entered the proximal jejunal limb and, as indicated in this roentgenogram, has remained there five days after being swallowed.

EXPERIMENTAL TOTAL GASTRECTOMY

Ivy, Richter, and Meyer (113) performed total gastrectomy on 20 dogs and observed these animals for various periods as long as eleven years. Not a single animal exhibited the blood picture of pernicious anemia, and spinal-cord changes were never observed. Hypochromic anemia occurred in a few males and invariably in all the female dogs when pregnant. A preliminary drop in blood chlorides after total gastrectomy with return to normal levels in two weeks was found. These investigators also discovered that the copper completely disappeared from the liver after total gastrectomy. A frequent cause of death in dogs subjected to total gastrectomy was enteritis; the cause of this complication was thought to be the loss of the bactericidal action of the gastric juice. Although the human appetite seems unimpaired after the operation, the gastrectomized dogs ate very slowly and their maintenance diets were necessarily greatly increased because of the considerable amount of undigested residue in the feces.

Mann and Graham (152) also performed total gastrectomy on dogs, and reported that no anemia resulted as late as four years after the operation.

Mullenix, Dragstedt, and Bradley (170) also concluded that the gastrectomized dog showed no tendency to develop anemia. Baisset, Ducuing, and Soula (14) observed a severe anemia occurring in only 3 of 13 dogs subjected to total gastrectomy. In 89 successfully gastrectomized rats, the occasional anemia which appeared was always of the hypochromic type (Maison *et al.* [150])

Bussabarger, Ivy, Gunn, and Wigodsky (33) performed total gastrectomy on monkeys without affecting the blood count in these animals. Bence (23) performed total gastrectomy on Yorkshire pigs, many of which developed a microcytic type of anemia. Gastrectomies done on 4 Yorkshire swine by Waterman, Kok, and Hirschfeld (256) resulted in a hyperchromic anemia in 3 of the animals in about three months after operation.

According to Petri, Boeggild, Ohlsen, and Busch (184), young dogs and pigs that develop pellagra after total gastrectomy, are relieved by the administration of human gastric juice or dried hog stomach, and not by vitamin B. Bouisset and Duclos (26) have stated that total gastrectomy does not interfere with the absorption of alimentary calcium or phosphorus. Gastrectomized puppies developed spontaneous fractures and deformities, but not rickets.

The experiments of Shumacker and Wintrobe (218) suggest that the extreme sensitivity of totally gastrectomized dogs to carbon tetrachloride is probably due to rapid absorption of this drug from the duodenum.

Emery (72) concluded that dogs without stomachs are unable to utilize nitrogen and fats as well as human beings who have undergone this operation. If, however, the diet were given slowly to these animals, so that the fat entered the duodenum at the approximate rate it would have left the normal stomach, its absorption was normal. This fact was true also of nitrogen absorption. Emery (72) believed, therefore, that the degree of intestinal dilatation occurring after total gastrectomy determined the efficiency of digestion by influencing the rate at which the patient could eat.

THE METABOLIC ABNORMALITIES CONSEQUENT TO TOTAL GASTRECTOMY

Previous studies from this Service have demonstrated that patients with gastric cancer almost uniformly suffer from metabolic abnormalities (2). These individuals frequently are unable to distribute vitamin A normally between the plasma and the hepatic stores; to fabricate hemoglobin, plasma albumin, and prothrombin from administered nitrogen; and to synthesize and conjugate glucuronic acid. These observations suggested that the basis of these disorders probably was a generalized hepatic dysfunction. More detailed hepatic-function studies proved this suggestion to be the case. Moreover, the existence of hepatic dysfunction in patients with gastric cancer was found to be associated with an abnormal chemical composition of their livers.

Although many of the metabolic abnormalities found in these patients subside after the surgical removal of the lesion, these patients often have a persistent and difficult postoperative course. Weight loss, steatorrhea (192) marked negative nitrogen balance (11), hypoprothrombinemia (2), and refractory anemia (2) especially are noted to mark the postoperative periods of patients who undergo total gastrectomy.

Absorption of fat. In order to ascertain the cause of the marked weight loss sustained by patients who underwent complete gastric resection, it became necessary to investigate their ability to digest and absorb simple dietary constituents from their alimentary tracts. Only the absorption of fat has been investigated in detail thus far. Three patients who survived total gastrectomy for from six to eighteen months were studied (192). These individuals, on a constant diet which contained 40 gm. of fat, were found to excrete an average of 15.6 gm. per day, or about five times the average amount excreted by a group of control subjects who took similar diets. This increased output of fat was readily shown to be of dietary origin, but the cause of the steatorrhea has thus far remained obscure. Among the factors considered were:

1. Intestinal motility. Since the patients lacked a stomach, it was possible that they no longer had a proper regulatory mechanism for the flow of food through their intestines. However, it was found that a patient who had undergone only a subtotal gastrectomy and retained the pyloric third of the organ, likewise excreted abnormally large amounts of stool fat. Furthermore, by the administration of charcoal, the time required for the passage of food through the alimentary tract of patients who underwent complete gastric resection was within normal limits. Roentgenographic examination of these individuals confirmed the observation that the gastrointestinal motility was normal.

2. Lack of gastric secretion. The daily addition of 33 gm. of ventriculin for ten days to the diet of these patients did not reduce their abnormal excretion of stool fat. Neither could the steatorrhea be influenced by the administration of the usual therapeutic doses of hydrochloric acid. Moreover, the patient who had a partial gastric

resection and developed steatorrhea postoperatively, nevertheless had free hydrochloric acid intragastrically.

3. Presence of gastric cancer. The possibility was considered that the previous existence of the gastric cancer had induced the development of steatorrhea. This suggestion was not tenable because the fecal excretion of lipid by patients with gastric cancer *in situ* was found to be within normal limits.

4. Pancreatic function. Since the increased amounts of fat excreted were found to be dietary in origin, the most likely cause of the steatorrhea appeared to be an inability of the patients to digest the fat for its proper absorption through the gastrointestinal mucosa. The administration of large amounts of bile salts was without significant effect. However, 1 of the 3 patients received daily 25 gm. of enteric-coated pancreatic enzymes, which decreased his stool fat output from 20 to 7.5 gm. per day. The withdrawal of the pancreatic enzymes from that patient's diet was followed within a few days by the reappearance of the steatorrhea.

In summary, then, of 3 patients who were subjected to total gastrectomy for the existence of gastric cancer, all suffered from steatorrhea. This steatorrhea apparently is related to the dietary content of fat and to a lack of fat-splitting digestive enzymes. It is especially interesting to note that no organic disease of the pancreas has been suspected in these individuals. It is, therefore, conceivable that the weight loss, dyspeptic symptoms, and perhaps an eventual deficiency of fat-soluble vitamins could be attributed in part to the steatorrhea.

Postoperative nitrogen loss. During the last few years it has been the clinical experience of this Service that the postoperative complications attributable to hypoproteinemia were encountered more frequently in patients with gastrointestinal cancer than in individuals with other disorders. This observation suggested that patients with cancer of the gastrointestinal tract, including those who undergo total gastrectomy, were more prone postoperatively to develop seriously low levels of serum protein. The reason for this tendency was not apparent.

Of 3 patients who underwent total gastrectomy, all were found to be hypoproteinemic before operation (11). During the first five postoperative days these individuals received from 6 to 18 gm. of protein nitrogen, and in this same period they excreted in their urine from 44 to 55 gm. of nitrogen. This marked negative nitrogen balance was associated in all 3 instances with a further reduction of the serum-protein concentrations to very low levels.

The increased hypoproteinemia was, of course, to be expected since the patients were in negative nitrogen balance. The postoperative nitrogen loss, however, could not be attributed to the severity of the operative procedure, for in another group of 33 patients with gastric cancer who underwent procedures which ranged from a simple laparotomy to subtotal gastrectomy, all developed postoperatively a degree of nitrogen loss and hypoproteinemia equal to that which occurred in the 3 patients who had had complete gastric resection.

However, it was surprising to note that in a second group of 9 patients with non-neoplastic gastric disorders who were submitted to surgical procedures similar to those undergone by patients with gastrointestinal cancer, the postoperative nitrogen loss was as great as that experienced by the latter patients, *yet no significant hypoproteinemia developed* (11). The explanation for this observation probably is that (a) the tissue-protein stores of patients with gastrointestinal cancer are depleted and, therefore, cannot maintain the serum-protein concentration at the preoperative levels, and (b) the ability of these individuals to fabricate serum protein is impaired considerably during their immediate postoperative course. It has been shown that even preoperatively the patients with gastrointestinal cancer are hypoproteinemic, and from evidence recently presented, a decreased concentration of serum protein in most instances reflects a serious depletion of tissue proteins. When hypoproteinemia exists, only 3 per cent of ingested nitrogen is fabricated into plasma proteins and the remainder is used to replenish the tissue protein supply (202). Accordingly, the hypoproteinemia observed preoperatively in the patients with gastrointestinal cancer may be due in part to the fact that the protein stores of these individuals already are too small to maintain a constant serum-protein level under the stress which results from surgical manipulation and the inevitable nitrogen fast following operation.

The impaired ability of patients with gastrointestinal cancer to fabricate serum albumin probably contributes to their significant degree of postoperative hypoproteinemia. A previous study from this Service strongly suggested that this impaired ability is due to a hepatic dysfunction which, like other hepatic dysfunctions, conceivably is aggravated further when the patients are subjected to surgery and manipulation of the liver (4).

Hypoprothrombinemia. A study of the levels of prothrombin in the plasma of 6 patients subjected to total gastrectomy revealed that in all the level had fallen from 20 to 45 per cent of the preoperative concentrations. Unfortunately, the hypoprothrombinemia in these individuals does not respond well to the parenteral administration of vitamin K. Even after the injection of from 4 to 6 mgm. of this substance, the prothrombin level increased only in 1 instance, did not change in 3, and actually decreased further in 1. Whereas before operation only 4 of the group had reduced plasma levels of prothrombin, that abnormality existed in all after the operation and even after the injection of vitamin K (11). Hypoprothrombinemia which is refractory to the parenteral administration of large amounts of vitamin K is most likely on the basis of hepatic dysfunction. However, in contrast to other dysfunctions of the liver in patients with gastrointestinal cancer, that of refractory hypoprothrombinemia does not subside after surgical removal of the growth (4).

REFRACTORY ANEMIA

Although the degree and incidence of anemia in patients whose gastrointestinal neoplasms have been removed are less than those of patients still bearing the tumor, a mild degree of anemia sometimes persists, especially in those patients who undergo total gastrectomy. Moreover, the anemia in many of these patients occasionally has been confused with addisonian pernicious anemia, often for no better reason than that it was expected that resection of the stomach must induce a hyperchromic, macrocytic anemia.

However, a more careful study of the blood pictures presented by 53 patients, who here and elsewhere had been subjected to total gastrectomy, reveals that only 27 had red-cell counts less than 4,000,000. In only 7 of these 27, the anemia was hyperchromic. In 3 it was normochromic, in 9 hypochromic, and in 8 the color index was not given. Moreover, only 6 of the 27 were stated to have macrocytic anemia, and in but 2 of these 6 the macrocytes were hyperchromic. Hence, it would appear that among the 53 patients whose postoperative blood findings were reported in the literature or by follow-up reports from surgeons in the United States and Canada, macrocytic hyperchromic anemia was not a common finding. Furthermore, no correlation could be made between the length of time the patient survived after the operation and the type of anemia which then existed.

When the macrocytic anemia which was noted after total gastrectomy was not truly of the addisonian type long before the existence of gastric cancer was suspected, certain differences from the typical pernicious anemia were found to exist.

Feature	Addisonian anemia in relapse	Macrocytic anemia of gastric cancer or after gastric resection
Color Index	Hyperchromic	Usually normochromic
Leucopenia	Frequent	Not common
Hepatic hemosiderosis	Common	Not noted
Effect of parenteral liver extract in adequate amounts	Reticulocytosis and remission	Often little or no effect

In conclusion, then, it is important to emphasize that although the removal of the cancer from patients with malignant growths of the gastrointestinal tract often is followed by the disappearance of certain metabolic disorders, other dysfunctions persist and even develop after the operation. Total gastric resection, however necessary for the proper surgical treatment of the patient, thus may give rise to new and difficult problems which must be recognized in time to prevent serious postoperative complications.

THE PROBLEM OF POSTOPERATIVE FEEDING

All patients with gastric cancer are in a disturbed metabolic state; the combination of impaired food intake due to anorexia or obstructive lesions at the cardia or pylorus, impaired digestion and absorption of foods, and, even more important, disturbed functioning of the liver offers great handicaps, not only for immediate operative survival but also for rapid restoration of these normal functions toward the speedy convalescence of the patient without complications. In the section on metabolic studies more detailed data are presented concerning the impairment of liver function which is associated with the presence of cancer in the stomach. After the removal of the gastric cancer these metabolic deficiencies, particularly dysfunction of the liver (as represented by hypoproteinemia and so forth), may lead to serious complications such as a lowered resistance to infection, impairment of wound healing (abortive desmoplasia, which in itself may result in either disruption of the line of anastomosis or of the abdominal wound), refractory anemia, the hepatorenal syndrome, impaired water and electrolyte balance with possible edema either of the small intestine with ileus, or of the lungs with pulmonary edema and later pneumonia, embolism, and thrombosis. As these conditions are important for the patient who undergoes partial gastrectomy, they are even more critical in the case of the patient undergoing

total gastrectomy, because this individual usually has a more advanced cancer, the operative procedure itself is more shocking and time-consuming, and, finally, the postoperative course is usually more hazardous and difficult to guide.

Many of the features of management of the patient during this period will be discussed under the avoidance of complications. The problem of feeding is one that can be solved by three approaches. Some surgeons prefer to institute immediate or delayed oral feedings in small quantities at frequent intervals, graduating the quantity and consistence of the food on succeeding days, as is usually practiced in the case of routine gastroenterostomies. If the anastomosis is secure, the stoma spacious and patent, and the tissues viable without danger of later necrosis and rupture, this method of oral feeding may be safe and has proved to be so in some hands. However, the amount of food so given must be limited during the first postoperative week as its exhibition entails a certain risk from pressure on the delicate anastomosis. We wish to call attention again to the alternate method either of performing a jejunostomy in the distal limb brought out through the flank in a separate stab wound, or introducing a Levine tube through the mouth, through the esophagojejunostomy, down the distal jejunal limb far beyond the supplementary enteroenterostomy. Through either of these tubes the patient may immediately be fed a high caloric, high protein diet.

Blood transfusions are given postoperatively as indicated. The hypoproteinemia may be combated by the intravenous administration of blood plasma or of concentrated human serum albumin; the effectiveness of this method of treatment is now too well known to need supportive argument here, but the fact remains that proteins when given by mouth are infinitely more effective in restoring the serum protein levels to normal limits than when given intravenously. Furthermore, the method is much less dangerous because it is free from the occasional hazard of protein shock, unfortunately seen sometimes after the administration of plasma.

The high caloric, high protein liquid diet given by means of these tubes contains the necessary vitamin supplement, so that it need not be given parenterally. If this food is given in too large quantities at a time it induces severe intestinal colic with nausea and retching; therefore we have found it best to administer the feedings by the Murphy drip method requiring from twelve to fifteen hours of each twenty-four-hour-period for delivery of the total quantity of food necessary. By this slow administration we avoid the unpleasant complications of massive jejunal feedings, one of which is a severe diarrhea. When diarrhea ensues it may be due to an excessive quantity of glucose or lactose in the feedings; therefore this is deleted temporarily.

At the end of the first week the patient is permitted to swallow clear fluid by mouth in small quantities, 1 oz. hourly. If this results in no unusual disturbances the quantity is gradually increased until at the end of the second week the tube feedings may be entirely discontinued and the tube withdrawn. The jejunostomy tube or intraoral jejunal feeding tube is never withdrawn in less than fourteen days following the operation, because if a fistula does develop it is most important that the tube remain in place until the fistula heals.

In the absence of a stricture at the site of anastomosis, the terminal esophagus and the jejunal loops dilate to take over somewhat the mechanical function of the stomach. The wall of the bowel becomes hypertrophied and together the proximal and distal jejunal limbs constitute a pouchlike substitute for the stomach.

The water balance of the body during the immediate postoperative state is controlled by the parenteral administration of salt, with or without glucose.

OPERATIVE MORTALITY

Many years ago it was said that any surgeon who removed a portion of the stomach had no thought but to kill two at a single blow, the patient and his own reputation. The operation of total gastrectomy will always be more hazardous, but from a study of Table V, it will be seen that the operation is now being performed with increasing frequency and greater safety in each successive decade. An operative mortality averaging only 37.6 per cent for the 298 total gastrectomies for cancer which were reported from 1884 to the present date gives us good reason for optimism. The operative mortality in the period prior to 1921 was 49.3 per cent; from 1921 to 1930 it was reduced to 31.6 per cent; and from 1931 to date the percentage of patients failing to survive this major procedure was 34.3 per cent. However, it was during this last period that 55 per cent of all the total gastrectomies were performed. This may account for the slight increase in operative mortality, due perhaps to the more general use of this operation. There were 6 operative deaths in the authors' series of 20 cases of total gastrectomy, which represents an operative mortality of 30 per cent.

TABLE V.—OPERATIVE MORTALITY OF TOTAL GASTRECTOMY FOR CARCINOMA, ACCORDING TO TYPE OF OPERATION AND PERIOD OF TIME

A. Total from 1884 to Date

Operative Procedure	Total Cases		Operative Survival		Operative Mortality	
	Number	Per cent	Number	Per cent	Number	Per cent
Total	298	100.0	186	62.4	112	37.6
Esophagojejunostomy	228	76.5	150	65.8	78	34.2
Esophagoduodenostomy	54	18.1	32	59.3	22	40.7
Procedure not specified	16	5.4	4	25.0	12	75.0

B. From 1884 to 1920

Total	75	100.0	38	50.7	37	49.3
Esophagojejunostomy	33	44.0	19	57.6	14	42.4
Esophagoduodenostomy	31	41.3	18	58.1	13	41.9
Procedure not specified	11	14.7	1	9.1	10	90.9

C. From 1921 to 1930

Total	57	100.0	39	68.4	18	31.6
Esophagojejunostomy	37	64.9	27	73.0	10	27.0
Esophagoduodenostomy	17	29.8	10	58.8	7	41.2
Procedure not specified	3	5.3	2	66.7	1	33.3

D. From 1931 to Date

Total	166	100.0	109	65.7	57	34.3
Esophagojejunostomy	158	95.2	104	65.8	54	34.2
Esophagoduodenostomy	6	3.6	4	66.7	2	33.3
Procedure not specified	2	1.2	1	50.0	1	50.0

In addition to the 298 recorded total gastrectomies for cancer, there were 2 collected cases of total gastrectomy for benign and non-neoplastic lesions with no deaths. There were also recorded 3 instances of total gastrectomy for sarcoma with the patients still living and well. The operative mortality for all total gastrectomies combined was 36.9 per cent.

The esophagojejunal anastomosis has gradually supplanted esophagoduodenostomy as the operator's choice. Prior to 1921, these procedures were almost equally popular; in the decade from 1921 to 1930 less than one-third of the operations were completed by esophagoduodenal anastomosis; and from 1931 to date, only 3.6 per cent were completed with the aid of this technique. The reasons for this deserved unpopularity are (1) the technical difficulties and almost universal unsuitability of the method, and (2) the constantly high operative mortality. For example, prior to 1921, the operative mortality for those cases in which esophagoduodenostomy was done was 41.9 per cent, yet in the next decade the mortality rate of 41.2 per cent showed no improvement. In the last period the number of operations completed by this method dropped to 5 and for comparative purposes the mortality rate has little significance.

In 11 reported cases, no anastomosis was done. In 3 of the instances, the patient died of shock on the operating table, but in the remainder, it was apparently technically impossible for the operator to complete the anastomosis, after resecting the stomach. The cases are listed as follows:

Case 1 Conner	Patient died on the operating table.
Case 4 Noble	An esophagoduodenostomy would have been done but the patient died on the operating table.
Case 7 Chavasse	Esophagus closed. Duodenum sutured to the skin. Postoperative death.
Case 18 Wright	Distal esophagus tied off. Duodeum exteriorized. Death in twenty-four hours.
Case 21 Ito and Asahara	Esophagus closed. Duodenum sutured to the skin. Postoperative death.
Case 40 Daneel	Esophageal and duodenal stumps sutured to the abdominal wall and connected by a tube. Patient died of pneumonia on the 37th postoperative day.
Case 41 Riese	Esophagus sutured. Postoperative death.
Case 46 Keding	Esophagus and duodenum not sutured but drained. Postoperative death.
Case 47 Haeberlin	Esophagus closed. Jejunostomy. Postoperative death.
Case 54 Altschul	Esophagus drained. No anastomosis. Death in forty-eight hours from peritonitis.
Case 86 Charrier and Charbonnel	No anastomosis. Death due to immediate shock.

COMPLICATIONS FOLLOWING TOTAL GASTRECTOMY

The three most common complications following total gastrectomy were peritonitis, pneumonia, and shock.

Peritonitis or abscess formation. Peritonitis occurred as a complication in 28.8 per cent of patients undergoing total gastrectomy and for whom this information was available. Not only was it the most common cause of death, but it was the most frequent complication of the operation. The means of preventing this accident are discussed in some detail in the section dealing with the cause of death. Careful preoperative cleansing of the stomach with one-tenth normal hydrochloric-acid lavages, the avoidance of peritoneal contamination at the time of operation, the prophylactic use of sulfathiazole or sulfadiazene both by oral administration and by placement in the operative region at the time of operation have all been mentioned. The constant utilization of the principle advocated in the section on operative technique should be stressed, namely, recognition of the poor blood supply of the distal esophagus and the construction of a secure anastomosis with interrupted sutures supplemented by diaphragmatic peritoneal flaps for added security, the latter being extremely important. The acceptance of the imminent possibility of leakage by the surgeon will stimulate him to plan for this possible complication or emergency by the introduction of drains, as previously described. Escape of secretions from the esophagus and jejunum into the abdominal cavity in the absence of drainage will invariably cause a fatal peritonitis, or, at best, a localized abscess. The prevention of peritonitis is more important than the treatment of this complication.

Pulmonary complications. The incidence of pulmonary complications following total ablation of the stomach is high (Table VI). This is readily appreciated when one realizes the long duration of anesthesia, the height of anesthesia necessary to operate at the level of the diaphragm, and the trauma to which the diaphragm itself may be subjected, as well as other factors involved. Every patient should have the benefit of medical consultation when pulmonary complications are suspected. Bronchopneumonia is handled so successfully by the intelligent use of the sulfonamide compounds, particularly sulfathiazole and sulfadiazene, that further comment at this time is unnecessary.

The initial pulmonary complication is atelectasis, which may be of a major or a minor character. A really important method of prophylactic treatment is that which has been described by Bartlett (21) and also by Zollinger (265), which we have employed with considerable success at the Memorial Hospital. This consists of the injection of eucupine in oil into the intercostal nerves at the end of the operation while the patient is still under anesthesia. This procedure in the large proportion of cases abolishes wound pain and enables the patient to pass through the first two to four postoperative days requiring only an occasional injection of morphine. Even more important, however, is the fact that the normal preoperative level of pulmonary vital capacity is usually maintained by this method of prophylactic treatment. The procedure which is performed at the Memorial Hospital on our Service by Wawro is as follows:

Eucupine in oil is injected intercostally from the thoracic 6th to the thoracic 11th spaces, either bilaterally along the posterior axillary line if the incision is midline, or unilaterally for right or left upper pararectal incisions. Two to three cubic centimeters of this substance are directed into each intercostal nerve. Wawro applied this technique to our patients who were subjected to subtotal or total gastrectomy either by the transthoracic or by the transperitoneal approach. A Benedict-Roth spirometer with attached ventilometer was employed. Basal spirograms were obtained and postoperative spirograms were taken on the first, second, third, fourth, sixth, eighth, tenth, thirteenth, sixteenth, and twentieth days. All the surgery was performed under spinal anesthesia supplemented by pentothal sodium given intravenously and gas oxygen ether. In the immediate postoperative period patients having undergone total gastrectomy suffer a drop in vital capacity of from 25 to 40 per cent of the normal. This is attended by a concomitant rise in the respiratory rate, increase in ventilation, and in the minute volume measured in terms of liters per minute. A follow-up over a period of three weeks reveals that the vital capacity does not return to normal at the end of this period, at which time patients are usually discharged. When these patients subjected to total gastrectomy are given an intercostal injection of eucupine in oil the vital capacity remains almost normal in the greater percentage of instances. It has been interesting to note that up until this treatment was given in the immediate postoperative period, all patients subjected to total gastrectomy developed pulmonary atelectasis in some degree. In 5 patients who were subsequently given the benefit of the injection of eucupine in oil into the intercostal nerves, only 1 developed postoperative atelectasis. The results in this small series certainly warrant an

TABLE VI.—COMPLICATIONS FOLLOWING TOTAL GASTRECTOMY

Complications	Total		Esophagojejunostomy		Esophagoduodenostomy		Procedure not specified	
	Number	Percent	Number	Per cent	Number	Per cent	Number	Per cent
Cases for which information was given	132	100.0	99	100.0	26	100.0	7	100.0
Abdominal Complications								
Peritonitis	38	28.8	25	25.3	8	30.8	4	57.1
Fistula	10	7.6	8	8.1	2	7.7		
Diarrhea	6	4.5	5	5.1	1	3.8		
Infection	5	3.8	5	5.1				
Hemorrhage	2	1.5			2	7.7		
Duodenal fistula	2	1.5	2	2.0				
Intra-abdominal abscess	2	1.5	1	1.0	1	3.8		
Subdiaphragmatic abscess	2	1.5	2	2.0				
Subphrenic abscess	1	0.7	1	1.0				
Abscess of abdominal wall	1	0.7			1	3.8		
Intestinal obstruction	1	0.7	1	1.0				
Acute colitis	1	0.7	1	1.0				
Enteritis	1	0.7			1	3.8		
Threatened evisceration	1	0.7	1	1.0				
Pulmonary Complications								
Pneumonia and/or atelectasis	22	16.7	21	21.2			1	14.3
Thoracic empyema	5	3.8	5	5.1				
Pulmonary edema	3	2.3	3	3.0				
Mediastinitis	2	1.5	2	2.0				
Pleuritis	2	1.5			1	3.8	1	14.3
Pulmonary embolism	1	0.7	1	1.0				
Asthma	1	0.7	1	1.0				
Fluid in the chest	1	0.7	1	1.0				
Cardiovascular Complications								
Heart disease	6	4.5	4	4.0	2	7.7		
Shock	17	12.9	7	7.1	7	26.9	3	42.9
Thrombophlebitis	1	0.7	1	1.0				
Hemiplegia	2	1.5	2	2.0				
Thrombosis of mesenteric artery	1	0.7	1	1.0				
Other Complications								
Parotitis	5	3.8	5	5.1				
Exhaustion	3	2.3	2	2.0	1	3.8		
Hypoproteinemia	3	2.3	3	3.0				
Stomatitis	2	1.5	2	2.0				
Anuria	2	1.5	2	2.0				
Dysuria	1	0.7	1	1.0				
Anemia	1	0.7	1	1.0				
Steatorrhea	1	0.7	1	1.0				
Pellagra	1	0.7	1	1.0				
Inanition	1	0.7	1	1.0				

extension of the use of this prophylactic agent in the hope that this complication will be encountered far less frequently than is the case at the present time.

Careful nursing with the patient being turned from side to side in bed very frequently, and limitation of the use of morphine are the next most valuable prophylactic measures. Inhalation of a mixture of carbon dioxide and oxygen for five minutes every two hours to induce hyperpnea, as well as the alternative use of blow bottles should be routinely practiced.

If atelectasis occurs and is recognized there is no procedure more valuable than the immediate performance of suction bronchoscopy. Bronchoscopic equipment is constantly available for these patients during the first few postoperative days. The surgical residents on our Service are all trained in the technique of performing bronchoscopic aspiration under local anesthesia. A complete reversal of what seems to be a very alarming symptom appears almost miraculously after the bronchi have been actively cleared of secretions and mucous plugs.

Shock. The attempt must always be made to prevent the occurrence of shock rather than to treat it after it occurs. Except at the hands of a very few operators, the performance of total gastrectomy with esophagojejunostomy and enteroenterostomy, and occasionally jejunostomy at a single operative seance requires considerable time and anesthesia, and the routine use of either plasma or whole blood by transfusion during the operation should be a standard part of the procedure. Such high concentrations of oxygen are usually maintained by the anesthetist for an extended time that it is frequently advisable to employ oxygen intranasally or an oxygen tent postoperatively for the first twenty-four hours. The necessity for this therapy will gradually decrease and after a short time it is discontinued entirely. The introduction of plasma transfusions has played a great part in the successful treatment of postoperative shock, which was often managed improperly by large infusions of normal salt solution.

Vascular accidents. The incidence of thrombophlebitis and phlebothrombosis is fortunately not very high in the postoperative state of these patients, according to our experience. Frequent dorsiflexion of the foot is recommended with elevation of the extremities as a prophylactic measure. This should begin as soon as the patient is conscious. If there are signs of impending phlebitis, injection of the lumbar paravertebral ganglia with novocain is recommended. If this is ineffectual proximal ligation of the saphenous or femoral vein is urged with evacuation of the clot. Heparinization is indicated if the previous measures fail, although its use would be urged sooner in the cycle if the drug were more available and less expensive.

Obstruction of the anastomosis. Obstruction at the site of the esophagojejunostomy is most apt

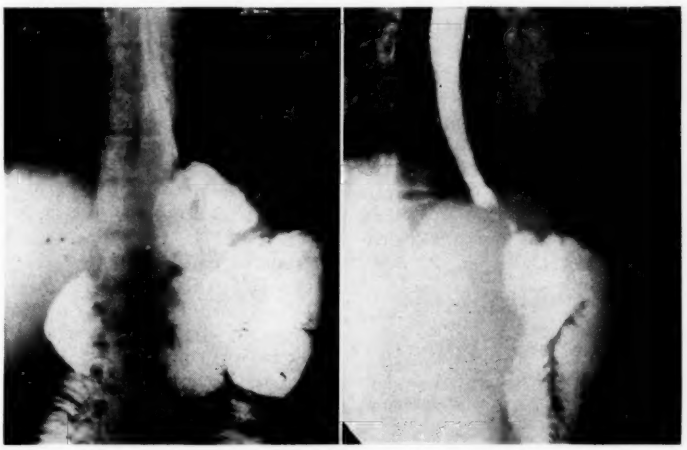


Fig. 16. Postoperative x-ray studies following total gastrectomy. Left, J.C. Case 5. Normally functioning esophagojejunostomy, utilization of both proximal and distal jejunal limbs. Right, D.G. Case 15. Normally functioning esophagojejunostomy. The barium is shown to descend through both jejunal limbs.

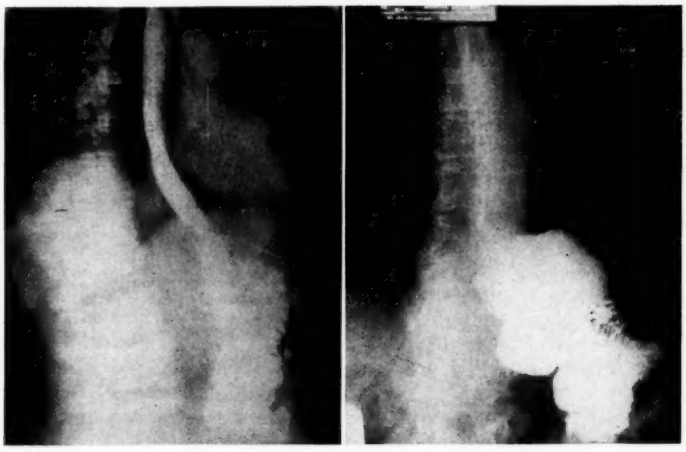


Fig. 17. Left, G.W. Case 16. Normally functioning esophagojejunostomy. Right, A.Z. Case 7. Normally functioning esophagojejunostomy.

to occur subsequent to a leak in the anastomosis with gradual closure by scar formation. This may be such a complete process that continued feeding by jejunostomy is necessary. Dilatation by esophagoscopic manipulation and bouginage is the only nonoperative treatment which has any hope of success. Obstruction at the site of the entero-enterostomy or jejunostomy due to kinking or adhesions quite naturally demands operative intervention and correction. In only 2 of the authors' series of 20 cases did obstruction occur; in 1 it was due to a breakdown in the anastomosis with fistula formation. In the other patient the obstruction was due to a recurrence of the carcinoma at the site of the anastomosis. In a survey of the literature of 132 cases in which information on the postoperative complication was given, the complication of obstruction was listed in only 1 case. It is our opinion that this occurrence is far more frequent than this figure would indicate and that as more patients survive the operation, the complication of stricture formation will increase in importance.

CAUSE OF DEATH FOLLOWING TOTAL GASTRECTOMY

A. Immediate Postoperative Death.

Peritonitis accounted for nearly 40 per cent of the immediate deaths following the operation. The cause of death was listed for 93 patients (Table VII). The operation is time-consuming and the opportunities for contamination are great. Scrupulous attention to preoperative preparation of the patient and frequent gastric lavage with one-tenth normal hydrochloric acid will accomplish much toward lessening this hazard. The stomach should be empty at the time of operation; a residual Levine tube in the stomach with frequent aspirations during the operation will diminish the danger of spillage during the process of constructing the anastomosis.

Another source of infection is possible leakage through the line of anastomosis; most meticulous care in technique, including the use of a diaphragmatic peritoneal flap, may prevent some of these postoperative accidents, but occasional leakage will inevitably occur especially when the remnant of abdominal esophagus is short and the musculature of poor quality. When leakage from the line of anastomosis does occur, an external fistula is to be preferred to peritonitis. On this account we routinely insert two Penrose drains adjacent to the esophagojejunal junction at the completion of the operation; this is not done with the intention of draining a supposedly infected or contaminated field, but rather to establish a drainage tract in the event of subsequent leakage. The wisdom of this precautionary measure was seen in 3 of our patients who developed external fistulas with recovery. In a fourth case death occurred from an intra-abdominal abscess in six weeks. In several instances, 10 gm. of powdered sulfathiazole were dusted around the anastomosis and operative field because of surgical soiling; convalescence was uneventful in all patients except 1 who died following the development of the hepatorenal syndrome with anuria.

TABLE VII.—CAUSE OF DEATH FOLLOWING TOTAL GASTRECTOMY

A. Immediate Postoperative Death

Cause of death	Total		Esophagojejunostomy		Esophagoduodenostomy		Procedure not specified	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total postoperative deaths	112		78		22		12	
Not specified	19		12		2		5	
Specified	93	100.0	66	100.0	20	100.0	7	100.0
Abdominal Complications								
Peritonitis	36	38.7	24	36.4	8	40.0	4	57.1
Intra-abdominal abscess	1	1.1	1	1.5				
Hemorrhage	2	2.2			2	10.0		
Duodenal fistula	1	1.1	1	1.5				
Intestinal obstruction	1	1.1	1	1.5				
Subdiaphragmatic abscess	2	2.2	2	3.0				
Infection	1	1.1	1	1.5				
Enteritis	1	1.1	1	1.5				
Acute colitis	1	1.1	1	1.5				
Pulmonary Complications								
Pneumonia	17	18.3	16	24.2			1	14.3
Thoracic empyema	6	6.5	6	9.1				
Pulmonary edema	2	2.2	2	3.0				
Mediastinitis	2	2.2	2	3.0				
Pleuritis	1	1.1					1	14.3
Pulmonary embolism	1	1.1	1	1.5				
Cardiovascular Complications								
Heart failure	6	6.5	4	6.1	2	10.0		
Shock	17	18.3	7	10.6	7	35.0	3	42.9
Hemiplegia	2	2.2	2	3.0				
Thrombosis of mesenteric artery	1	1.1	1	1.5				
Thrombophlebitis	1	1.1	1	1.5				
Other Complications								
Exhaustion	3	3.2	2	3.0	1	5.0		
Inanition	1	1.1			1	5.0		
Anuria	2	2.2	2	3.0				

Shock is often present in some degree (18.3 per cent of operative deaths), but now can be prevented in the majority of cases. Spinal pontocaine, nupercaine, or continuous anesthesia supplemented by the intravenous administration of sodium pentothal is perhaps one factor in lessening the danger. Slow transfusions of citrated blood, given concurrently with the operation is an effective prevention of shock. If the liver function has been found to be subnormal by the discovery of low serum protein, low prothrombin, and low vitamin A levels in the blood, the preoperative administration of blood plasma, vitamin K, and vitamins A and B with choline, respectively, will be found of great value in protecting the liver.

Seventeen of the 93 patients for whom the cause of immediate postoperative death was given died of pneumonia. The incidence of pneumonia and atelectasis should be greater than occurs for most operations on the upper abdomen because of the character of the operation, the slight injury to the diaphragm, and the involuntary splinting of the lower chest during respiration. The three measures most useful in combating this complica-

TABLE VIII.—CAUSE OF DEATH FOLLOWING TOTAL GASTRECTOMY

B. Subsequent Death

Cause of death	Total		Esophagojejunostomy		Esophagoduodenostomy		Procedure not specified	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total subsequent deaths	92		80		10		2	
Not specified	12		10		1		1	
Specified	80	100.0	70	100.0	9	100.0	1	100.0
Metastases	66	82.5	61	87.1	5	55.6		
Intestinal obstruction	2	2.5	1	1.4	1	11.1		
Heart failure	2	2.5	2	2.9				
Anemia (reputed)	2	2.5	2	2.9				
Chronic nephritis	2	2.5	1	1.4	1	11.1		
Pneumonia	2	2.5	2	2.9				
General weakness	1	1.2	1	1.4				
Pulmonary tuberculosis	1	1.2			1	11.1		
Subphrenic abscess	1	1.2			1	11.1		
Acute enteritis	1	1.2					1	100.0

tion are: (1) prophylactic intercostal nerve blocking with eucupine in oil to allow greater respiratory excursion; (2) immediate use of the bronchoscope at the bedside when the first indication of atelectasis appears, and (3) the chemotherapeutic use of sulfapyridine, sulfathiazole, and sulfadiazine.

Duodenal fistula caused 1 death in this collected series and this accident followed an esophagojejunal type of anastomosis. Back pressure on the duodenal stump can always be avoided if a small supplementary lateral (Braun) anastomosis is made between the ascending and descending jejunal limbs.

Hemorrhage caused 2 deaths. An alarming source of hemorrhage is sometimes the splenic hilum or the related vessels, such as the junction of the splenic and left gastroepiploic vessels. It is sometimes necessary to remove the spleen together with the stomach in order to control this annoying and occasionally dangerous bleeding.

The operative deaths in the authors' personal experience were attributable to atelectasis and bronchopneumonia in 3 cases; bilateral bronchopneumonia and peritonitis in 1 case; and anuria and diaphragmatic abscess in 1 case each. The operation on the first patient was performed in a distant city where bronchoscopic aspiration was not attempted. The patient who died of peritonitis following the perforation of a slough at the suture line had accidentally received a gastric lavage with dilute hydrochloric acid rather than one-tenth hydrochloric acid on the morning of the operative day and the esophageal mucosa was somewhat cauterized. In the third case, acute focal liver necrosis was found at operation and the patient developed uremia and died on the third day.

B. Subsequent or Delayed Death Following Total Gastrectomy.

Of the 92 patients who died, at least 9 had no evidence of recurrent cancer at the time of death. Two patients died six years after the operation, from heart failure and pulmonary tuberculosis, respectively; a third died of anemia after four years, and another patient died of chronic nephritis three years and eleven months subsequent to the date on which the total gastrectomy (Table VIII) was done.

The greater number (over 80 per cent) of the 80 patients for whom the cause of death was given, died because of recurrent or metastatic cancer; practically none of these could have been salvaged at the time of operation because the procedure of total gastrectomy itself represents the very extreme of radical surgical treatment. The only means of converting this operation from a palliative to a curative endeavor would be by improvement in the early diagnosis and immediate surgical intervention, in which case partial rather than total gastrectomy might be more feasible.

In the authors' personal cases the cause of late death of 5 patients who successfully recovered from the operation, was as follows: metastasis to the liver in 2, diffuse metastases to bone in 1,

TABLE IX.—METASTASES AS A CAUSE OF SUBSEQUENT DEATH, IN RELATION TO THE PRESENCE OF METASTASES AT THE TIME OF OPERATION

Site of metastases	Total		Metastases present		Metastases not present		Metastases not specified	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Number of cases	67		24		8		35	
Not specified	26		7		2		17	
Specified	41	100.0	17	100.0	6	100.0	18	100.0
Abdomen	13	31.7	4	23.5			9	50.0
Liver	7	17.1	2	11.8	4	66.7	1	5.5
Cul-de-sac	5	12.2	4	23.5			1	5.5
Abdominal nodes	4	9.8					4	22.2
Pelvic viscera	3	7.3	1	5.9	1	16.6	1	5.5
Retroperitoneum	3	7.3	1	5.9			2	11.1
Peritoneum	3	7.3	2	11.8			1	5.5
Site of the anastomosis	2	4.9	2	11.8				
Esophagus	2	4.9	1	5.9			1	5.5
Colon	2	4.9	1	5.9			1	5.5
Bone	2	4.9	1	5.9	1	16.6		
Omentum	1	2.4					1	5.5
Perigastric nodes	1	2.4	1	5.9				
Operative scar	1	2.4	1	5.9				
Lungs	1	2.4	1	5.9				
Breast and axilla	1	2.4	1	5.9				
Left neck	1	2.4	1	5.9				

subphrenic abscess in 1, and irremediable obstruction at the site of the anastomosis following leakage. The last is more apt to occur if anterior esophagojejunostomy is not done with supplemental enteroenterostomy. If peroral bouginage fails, then a permanent Marwedel jejunostomy should be constructed with the distal jejunum, or a transthoracic, transdiaphragmatic excision should be made, and reconstruction of the anastomosis attempted.

TABLE X.—END-RESULTS OF TOTAL GASTRECTOMY FOR CARCINOMA

End-results	Total cases		From 1884 to 1920		From 1921 to 1930		From 1931 to date	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total	298	100.0	75	100.0	57	100.0	166	100.0
Operative deaths	112	37.6	37	49.3	18	31.6	57	34.3
Operative survivals—Total	186	62.4	38	50.7	39	68.4	109	65.7
Subsequent deaths—Total	93	31.2	11	14.7	22	38.6	60	36.1
Died with disease	78	26.2	7		19		52	31.3
Died without disease	9	3.0	4		3		2	1.2
Cause of death not indicated	6	2.0					6	3.6
Living—Total	93	31.2	27	36.0	17	29.8	49	29.5
Operative survival, under 3 months, no follow-up	38	12.8	12		9		17	10.2
Living with disease	5	1.6					5	3.0
Living without disease	50	16.8	15		8		27	16.3

END-RESULTS OF TOTAL GASTRECTOMY FOR CANCER

The value of the operation of total gastrectomy for cancer cannot be appreciated nor supported by a study of the cumulative end-results to date. An operative procedure which is frequently so technically difficult that it cannot enjoy much usage in the hands of general surgeons, which is followed by many immediate and late complications, and which has a mortality averaging 37 per cent and such discouraging end-results that only 16 survivors are known to have lived for more than three

TABLE XI.—END-RESULTS OF OPERATIVE SURVIVAL

End-results	Total cases		Metastases present at the time of operation		Metastases not present at the time of operation		Metastases not specified at the time of operation	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Total operative survivals	186	100.0	48	100.0	34	100.0	104	100.0
Dead—Total	93	50.0	30	62.5	16	47.1	47	45.2
With disease	78	41.9	30	62.5	10	29.4	38	36.5
6 months or less	23	12.4	9	18.7	3	8.8	11	10.6
7 to 12 months, inclusive	21	11.3	8	16.7	3	8.8	10	9.6
1 to 2 years	22	11.8	7	14.5	2	5.9	13	12.5
2 to 3 years	8	4.3	3	6.3	2	5.9	3	2.9
3 to 4 years	4	2.1	3	6.3			1	1.0
Without disease	9	4.8			2	5.9	7	6.7
6 months or less	1	0.5					1	1.0
7 to 12 months, inclusive	1	0.5					1	1.0
1 to 2 years	2	1.1					2	1.9
2 to 3 years	1	0.5					1	1.0
3 to 4 years	2	1.1			1	2.9	1	1.0
6 years	2	1.1			1	2.9	1	1.0
Cause of death not indicated	6	3.2			4	11.7	2	1.9
1 to 2 years	2	1.1			1	2.9	1	1.0
2 to 3 years	4	2.1			3	8.8	1	1.0
Living—Total	93	50.0	18	37.5	18	52.9	57	54.8
Operative survival, under 3 months, no follow-up	38	20.4	5	10.4	6	17.6	27	26.0
With disease	5	2.7	4	8.3	1	2.9		
3 to 6 months, inclusive	1	0.5	1	2.1				
7 to 12 months	1	0.5	1	2.1				
1 to 2 years	1	0.5			1	2.9		
2 to 3 years	2	1.1	2	4.2				
Without disease	50	26.9	9	18.8	11	32.3	30	28.8
3 to 6 months, inclusive	15	8.1	5	10.4	2	5.9	8	7.7
7 to 12 months	10	5.5	2	4.2	3	8.8	5	4.8
1 to 2 years	15	8.1	2	4.2	2	5.9	11	10.6
2 to 3 years	3	1.6			3	8.8		
3 to 4 years	4	2.1			1	2.9	3	2.9
4 to 5 years	2	1.1					2	1.9
8 years	1	0.5					1	1.0

The 186 operative survivals in the above table represent 62.4 per cent of the 298 cases of total gastrectomy for cancer.
Distribution as to the presence of metastases:
Metastases present..... 48, or 25.8 per cent.
Metastases not present..... 34, or 18.3 per cent.
Metastases not specified.....104, or 55.9 per cent.

years cannot receive much enthusiastic acclaim from the most incurable surgical optimist. Yet the one outstanding thought in this regard must be the admission of the possible success of the operation. The number of failures, unfortunately great though it may be, does not obscure the recognition of the accomplished fact that the operation can be performed and survivors have been able to live for years following the operation. As in the historical development of other operations of similar magnitude, the numerous failures, complications, accidents, and fatalities are the

TABLE XII.—POSTOPERATIVE DURATION

Metastases at the time of operation	Total		Dead		Living	
	Cases	Duration in months	Cases	Duration in months	Cases	Duration in months
Total	146	17.5	91	16.6	55	18.8
Present	42	14.5	30	15.0	12	12.9
Not present	29	20.1	16	22.0	13	17.7
Not specified	75	18.1	45	15.8	30	21.7

Cases which have not been followed up three months or more are excluded from the above figures.

TABLE XIII.—PATIENTS WHO LIVED THREE YEARS OR MORE FOLLOWING TOTAL GASTRECTOMY

A. Metastases Present at the Time of Operation

Author	Age and sex	Date of operation	End-results		Comments
			Dead	Living	
Clute, H. M. and Mason, R. L.	36 F	9/4/1929	After 3 years and 3½ months. Metastases to breast, axilla and cul-de-sac		For 3 years the patient was in good condition and able to work
Streicher, M. H.	45 F	12/1932	After 4 years. Metastases to the pelvic viscera		Macrocytic anemia developed at 3½ years
Morrison, W. B.	68 M	8/5/1938	After 3 years and 8½ months. Metastases to the lungs		Macrocytic anemia developed but responded well to liver

B. Metastases Not Present at the Time of Operation

Hartman, H. R.	58 M	8/1917	After 4 years. Pernicious anemia		
Roeder, C. A.	50 M	4/9/1932	After 6 years. Coronary block		Patient had always worked as a house painter until he dropped dead on the street
Morton, C. B.	48 F	1/11/1939		3 years	No evidence of recurrence or anemia and no complaints

C. Metastases Not Specified at the Time of Operation

Dollinger	35 M	4/1901		4 years and 9 months	Patient works as policeman
Dollinger	58 F	5/1902		3½ years	Patient feeling well
von Haberer, H.	55 M	12/4/1920	After 6 years. Pulmonary tuberculosis		
*Kobelt, H.	45 F	1/8/1916	After 3 years and 11 months. Chronic nephritis		
Rosenthal, N. and Abel, H.	51 M	6/1931	After 3 years		Cause of death not stated. No anemia occurred
Stahnke, E.	39 F	1/27/1931		Over 8 years	Progressive anemia developed 7 years postoperatively, which was treated with iron
Weese, K.	.....		After 3 years and 5 months. Metastases		
Wrede	36 M			4 years	Patient eating regular number of meals, not limited in diet. Works as locksmith
Ransom, H. K.	70 F	10/15/1937		4 years and 6½ months	Patient feeling well
Ransom, H. K.	52 M	11/18/1938		3 years and 5 months	Patient suffered from pernicious anemia since 1935 with good response to liver, but returned postoperatively when treatment was discontinued

*In this case esophagoduodenostomy was performed. In the other cases, esophagojejunostomy.

TABLE XIV.—TOTAL GASTRECTOMY FOR CARCINOMA

Case Reports from the Gastric Service of Memorial Hospital, New York, New York

Patient, age, and sex	Operation				Complications	End-results		Comments
	Date	Procedure	Findings and location	Histology		Dead	Living	
1. M.B. 59 M	8/21/1933	Esophagoduodenostomy. Marwedel incision and rib resection	Pars media, fundus, lesser curvature and cardia	Diffuse carcinoma, Grade iv, with nodal metastases. Chronic gastritis	Diarrhea and fistula	After 6 weeks. Subphrenic abscess		
2. D.S. 42 F	11/9/1938	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Drainage	Proximal half encircling the lumen	Linitis plastica without nodal metastases		After 2 years and 2 months. Widespread bone metastases		Patient discharged on 21st day. Well until January, 1940
3. L.W. — M	11/26/1939	Esophagojejunostomy, jejunojejunostomy, and jejunostomy	Pars media and fundus	Scirrhous carcinoma, linitis plastica type, with nodal metastases	Bronchopneumonia	On 8th day. Bronchopneumonia		
4. O.B. 50 M	1/23/1940	Esophagojejunostomy, jejunojejunostomy, and jejunostomy	Walls and lesser curvature	Gelatinous adenocarcinoma, Grade iii, with nodal metastases. Chronic gastritis	Peritonitis and pneumonia	On 7th day. Peritonitis and bronchopneumonia		Large dose of dilute HCl given preoperatively by mistake
5. J.C. 54 M	3/26/1940	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Diaphragmatic flaps. Drainage	Lesser curvature and pars media, extending to 1 cm. of esophagus	Scirrhous carcinoma without nodal metastases		After 1 year and 5 months. Liver metastases		At 4½ months definite steatorrhea and secondary anemia. Liver and vitamin therapy with good result
6. L.S. 62 F	7/2/1940	Esophagojejunostomy, jejunojejunostomy, and jejunostomy	Bulky carcinoma of the proxin al half	Adenocarcinoma, Grade iv, with nodal metastases. Atrophic gastritis	Atelectasis. Fistula which later closed. Pellagra	After 8 months. Recurrence		After discharge, patient suffered frequent attacks of heartburn
7. A.Z. 59 M	8/13/1940	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Diaphragmatic flaps	Walls and proximal third	Adenoma malignum, Grade ii, without nodal metastases. Atrophic gastritis	Atelectasis and threatened evisceration		2 years and 8 months	Patient complained of heartburn and fullness after meals. No evidence of disease and no anemia
8. F.B. 61 M	9/10/1940	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Sulfathiazole dusted around the anastomosis	Proximal third	Adenoma malignum. Grade ii, without nodal metastases	Asthma, fistula, and severe wound infection	After 10½ months. Liver metastases		
9. L.G. 62 M	5/27/1941	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Sulfathiazole dusted around the anastomosis. Drainage	Entire lesser curvature and pars media	Adenocarcinoma with nodal metastases	Hepatorenal Syndrome with anuria	On 3rd day. Anuria		Microscopic examination of the liver showed acute focal necrosis
10. E.F. 55 M	7/21/1941	Esophagojejunostomy, jejunojejunostomy, and jejunostomy	Fungating carcinoma of lesser curvature from pylorus to cardia	Adenocarcinoma, Grade ii, without nodal metastases. Atrophic gastritis			1 year and 8 months	No evidence of disease. Letter from patient 11/18/1942 stated he was working in a war plant
11. F.B. 46 M	11/7/1941	Esophagojejunostomy and jejunostomy	Cardia	Adenocarcinoma, Grade iv, perforating the serosa, with nodal metastases	Atelectasis and subdiaphragmatic abscess		1 year and 4 months	Palliative gastrectomy. Letter from patient stated that he was well, able to digest food easily, and that he walks two miles daily

TABLE XIV.—TOTAL GASTRECTOMY FOR CARCINOMA

TABLE XIV.—TOTAL GASTRECTOMY FOR CARCINOMA

Case Reports from the Gastric Service of Memorial Hospital, New York, New York

Patient, age, and sex	Operation				Complications	End-results		Comments
	Date	Procedure	Findings and location	Histology		Dead	Living	
12. L.R. 55 F	3/31/1942	Esophagojejunostomy, jejunojejunostomy, and jejunostomy	Ulcerating carcinoma of cardia	Adenocarcinoma, Grade iii, with multiple nodal metastases	Bilateral atelectasis requiring suction bronchoscopy		1 year	Difficulty in swallowing. Induration beneath abdominal scar suggesting recurrence
13. L.S. 65 M	3/24/1942	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Ten grams of sulfathiazole dusted around the anastomosis. Drains placed into the subdiaphragmatic space	Tumor of entire stomach invading pancreas and gastrocolic omentum by metastatic carcinoma	Adenocarcinoma, Grade iii, with nodal metastases	Atelectasis and subdiaphragmatic abscess	On 12th day. Exhaustion and subdiaphragmatic abscess		Seven-hour operation Leak on the 3rd day, apparently draining well and stopped. On the 11th day, atelectasis requiring bronchoscopy. Autopsy showed fissure at the esophagojejunostomy on the anterior wall leading into the abscess
14. E.L. 65 F	5/6/1942	Esophagojejunostomy, jejunojejunostomy, and jejunostomy	Carcinoma involving lesser curvature and penetrating all coats	Adenocarcinoma, Grade iv, diffusely infiltrating the wall with multiple nodal metastases. Surrounding mucosa is atrophic. Liver and omentum normal			10 months	Palliative gastrectomy. Recurrence near the scar and in the cul-de-sac. High-voltage x-ray therapy
15. D.G. 52 F	5/19/1942	Esophagojejunostomy, jejunojejunostomy, and tube in distal loop; no jejunostomy. Diaphragmatic flaps	Lesser curvature from 5 cm. above the pylorus to the cardia	Adenocarcinoma, Grade iii, without nodal metastases			10 months	Immediate condition good. Discharged on the 19th day. No evidence of disease
16. G.W. 60 F	5/27/1942	Esophagojejunostomy, retrocolic, and jejunojejunostomy. Drainage	Ulcerated carcinoma of lesser curvature and subcardiac region, slightly fixed to the lesser omentum	Adenoma malignum, Grade ii, without nodal metastases			10 months	Discharged on the 18th day. No evidence of disease or of obstruction at the cardia. Patient is in very good health
17. H.M. 57 M	11/7/1942	Esophagojejunostomy and jejunojejunostomy. Biopsy of the liver. Levine tube	Entire lesser curvature and mesentery of greater curvature	Adenocarcinoma, Grade iii, with metastases to all nodes. Liver biopsy negative	Slight hypoproteinemia Atelectasis and pneumonia in left base	On 4th day. Atelectasis and pneumonia in left base		
18. J.G. 58 M	11/18/1942	Esophagojejunostomy and jejunojejunostomy. Five grams of sulfathiazole sprinkled around the stumps. Levine tube. Penrose drains	Cardia invading the esophagus	Adenocarcinoma, Grade iii, with extension to the serosa. Metastasis to one node. There was also an intramural leiomyoma	Bilateral bronchopneumonia. Hypoproteinemia which did not respond well to transfusions	On 19th day. Bilateral bronchopneumonia		
19. E.W. 46 M	2/1/1943	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Biopsy of the liver	Deep ulcer on the lesser curvature in the mid-portion. The entire stomach was a rigid tube	Carcinoma with infiltrating portions showing the picture of linitis plastica. No metastases to nodes. Liver biopsy normal	Localized peritonitis due to a small leak at the suture line		Operative survival	The patient is well
20. H.G. 46 M	2/3/1943	Esophagojejunostomy, jejunojejunostomy, and jejunostomy. Biopsy of the liver	Lesser curvature in the middle and lower thirds	Diffuse anaplastic gelatinous adenocarcinoma, Grade iv, with metastases to nodes. Liver biopsy normal	Hypoproteinemia		Operative survival	The patient was discharged on the 23rd day

price paid for the accumulation of knowledge and group experience, by which the operation in question can become practical and safe. Now that the details concerning the operative technique of total gastrectomy, the avoidance and treatment of the surgical complications, and the metabolic disturbances associated not only with the disease but following the operation are more generally known, we may confidently expect that total gastrectomy for cancer may be considered no longer an operation of "hope" but an operation of "promise." The reward of the dozens of pioneer surgeons from the time of Conner (52) in 1884 to the present time, who have been intrepid and resourceful enough to attempt this operation, lies not in the mere 16 patients who to date have survived the operation for more than three years, but in the great future when the procedure will be commonplace, safe, and as curative as a surgical procedure for cancer can be.

The authors have performed total gastrectomy on 20 patients with the following end-results: There were 6 operative deaths, of which 4 were due to pneumonia, 1 to anuria, and 1 to subphrenic abscess. Of 5 patients, who subsequently died after discharge from the hospital, 1 developed an intra-abdominal abscess, and 4 died of metastases occurring from eight months to two years and two months after the date of operation. Two recent patients are living less than three months from the time of total gastrectomy. Two patients are living with recurrence at ten and twelve months, respectively. Five patients are living and well at the present time, at the postoperative periods of ten months, ten months, sixteen months, one year and eight months, and two years and eight months.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Ingraham, F. D., and Hamlin, H.: Spina Bifida and Cranium Bifidum. Surgical Treatment. *N. England J. M.*, 1943, 228: 631.

Satisfactory treatment of myelomeningocele and encephalocele entails the selection of patients suitable for operation—simple removal and repair of the defect adapted to the location, size, and shape of the protrusion, and meticulous postoperative care. Usually there is time for careful evaluation of the infant, including roentgenological examination. The size of the lesion and the nature of its protective coverings are noted. In the case of some of the more formidable lesions one may be obliged to await peripheral epithelization to obtain sufficient tissue for closure. The initial phase of treatment may be conservative home care until proper evaluation can be carried out. The small meningoceles, especially the cervicodorsal protrusions in infants who are neurologically normal and show no roentgen defect other than a localized spina bifida, can be operated upon during the first days or weeks of life with a good outlook.

The two essential features of any operation on the commoner protrusions are tight closure of the sac and firm closure of the skin and subcutaneous tissues. Reinforcement of the closure with fascial flaps is desirable if it can be done without prolonging the operation unduly. Reconstruction of the bony canal should never be attempted at this time, but if the defect is such that the bony spine is seriously weakened, a secondary procedure with a bone graft may be done. In the typical case an elliptical incision, which should be transverse in the case of lumbar or lumbosacral lesions, is made around the base of the mass. If the skin cannot be closed without tension, counterincisions or a Z flap should be used. The sac is opened through an area, preferably midline, that is free from nerve tissue. Nerves that may be functioning are preserved and the major portion of the sac is cut away to leave sufficient tissue to overlap the edges. If there is a large amount of tissue that may have potential function, it may be necessary to create a small secondary meningocele to preserve it.

The postoperative dangers are leakage of the spinal fluid, infection at the closure site, and meningitis. If there is any doubt about the possibility of making a firm closure, sulfadiazine is administered preoperatively and postoperatively. Proper dressing of the wound and protection against fecal contamination are emphasized. Diligent nursing care is essential. For cases in which cerebrospinal fluid pressure cannot be controlled by periodic tapping, a simple method of constant lumbar drainage is described.

JOHN L. LINDQUIST, M.D.

Simpson, W. L.: Osteomyelitis of the Skull Resulting from Infection in the Sinuses. *Arch. Otolar.*, Chic., 1943, 37: 463.

Eighteen cases of osteomyelitis of the skull resulting from infection in the accessory nasal sinuses are reported, and a discussion of the clinical and pathological features of the disease is presented. Most patients with osteomyelitis of the skull are between the ages of twenty and thirty years, but the author does not believe the age incidence is related to the frequency of operation on the frontal sinuses during this age period. Many operations are also done on older patients, and yet comparatively few infections of the bones of the skull occur between the ages of thirty and fifty years, because in the older patient the walls of the frontal sinus are denser and there is less diploic bone. The author believes that the larger the frontal sinus, the more severe the infection, and the less satisfactory the treatment of the sinusitis, the greater is the danger of osteomyelitis.

Most cases originate from the frontal sinus and very few from the ethmoid cells or antrum. It is probable that the sphenoid sinus is the source of infection in many more cases than is indicated by a study of the literature. Sinusitis arising during the course of infectious diseases is the usual precursor of osteomyelitis of the skull. In many cases swimming, with chilling of the body from long exposure, has been observed as a causative factor. Operative procedures on the sinuses, if judiciously done, do not often result in osteomyelitis of the skull. In cases of acute sinusitis, operation should be limited to establishing drainage. Opening the frontal sinus through the anterior wall, instead of entirely through the floor, may be a cause of osteomyelitis. The vigorous use of the curet or any use of the rasp is contraindicated. In only 1 of the author's cases did the osteomyelitis follow an operative procedure.

The staphylococcus is the infecting organism in most cases, but occasionally streptococci or other bacteria are the cause of osteomyelitis of the skull. In the early stages of the disease the gross appearance of the bone shows little change from the normal. Later the bone becomes white and avascular and finally appears worm-eaten with large openings in the cortex and discoloration. In routine microscopic examinations of bone obtained during complete ethmosphenofrontal operations, evidence of active osteomyelitis was found in practically all specimens, even though the condition was chronic and in a quiescent stage.

In practically all cases of osteomyelitis of the frontal region there is a puffy swelling of the soft tissues. Closure of the eye associated with pain in the sinus may indicate only periostitis or rupture of

the frontal or ethmoid sinus, but it may also denote beginning extensive osteomyelitis of the skull. The severity and duration of symptoms is variable. Redness of the skin simulating erysipelas and abscesses of the soft tissues of the frontal region are not uncommon.

Prophylactic treatment is concerned with avoiding long periods of swimming with chilling of the body, correction of nasal deformities and the removal of growths, and proper treatment of infections of the nose during acute infectious diseases. Operations for chronic sinusitis should be done only during a quiescent stage. If treatment is necessary in acute sinusitis, drainage alone should be done. The operative treatment of osteomyelitis of the skull requires the entire removal of all diseased bone without trauma to the surrounding tissue and the proper management of any complication which may have arisen. All bone from 1½ to 2 in. beyond the area of necrosis visible to the naked eye should be removed. According to the condition of the patient, exenteration of the entire mucous membrane of the frontal sinuses may be done at the same time or from one to two weeks later while the wound in the frontal sinus is still open.

Eighteen case reports with illustrations of operative procedures, roentgenograms, and specimens are presented. There were 3 deaths due to meningitis and brain abscess. JOHN L. LINDQUIST, M.D.

EYE

Friedenwald, J. S., Buschke, W., and Michel, H. O.: The Role of Ascorbic Acid (Vitamin C) in Secretion of Intraocular Fluid. *Arch. Ophth.*, Chic., 1943, 29: 535.

The authors discuss the role of ascorbic acid (Vitamin C) in the secretion of intraocular fluid. They point out that ascorbic acid is one of the reducing substances in the interstitial tissue of the stroma of the ciliary processes. Reducing substances facilitate the oxidation-reduction interaction between the stroma cells and the stroma-epithelium barrier. In guinea pigs on a Vitamin C free diet Vitamin C disappears from the tissues of the eye long before any constitutional symptoms of scurvy develop. Loss of ascorbic acid from the secretory system in the eye produces a decrease in the rate of transfer of basic dyes from the stroma to the epithelium and in the rate of secretion of intraocular fluid. The authors conclude that ascorbic acid is stored in the ciliary stroma and that oxidation of ascorbic acid by the ciliary epithelium seems to be a necessary step in the intraocular secretion of this substance.

JOSHUA ZUCKERMAN, M.D.

Gallaher, C.: A Study of Trachoma, with a Report of 318 Cases; 233 Treated with Sulfanilamide. *J. Oklahoma M. Ass.*, 1943, 36: 185.

The author discusses trachoma and its treatment with sulfanilamide. The cases were classified into 4 groups as follows:

Grade 1. The primary stage of trachoma—in which the conjunctiva is hyperemic and a small amount of mucopurulent material is present; small subepithelial follicles appear, particularly under the upper tarsal conjunctiva, and slight dilation of the vessels at the upper limbus and gray infiltration of the corneal substance are present.

Grade 2. A few bleblike raspberry excrescences containing a gelatinous substance appear, especially in the retrotarsal folds, and the changes in the cornea are more advanced.

Grade 3. Cicatrization and irregularities of the conjunctival surface and eversion or inversion of the eyelids occur.

Grade 4. Healed trachoma, pannus, and other sequelae resulting from cicatrization are present.

The following routine method of treatment was employed in a series of cases of active trachoma and its effect was observed in 199 cases:

For a period of ten days ½ gr. of sulfanilamide per pound of body weight per day was administered by mouth. This was followed by a small amount of water to which baking soda had been added. If fever, rash, or gastrointestinal disturbances occurred, sulfanilamide was discontinued. After routine sulfanilamide treatment, grattage (followed by the instillation of 1 per cent sulfanilamide in Ringer's solution) was performed in some cases of the grade 2 type of trachoma. After or during routine sulfanilamide therapy ½ per cent zinc-sulfate ointment was introduced into the lower cul-de-sac at bed time. Sulfanilamide solution was instilled routinely for from one to three months following the administration of sulfanilamide by mouth. Vitamin A in oil was used locally for cases which presented phlyctenules or acute keratitis and from 25 to 50,000 units of vitamin A were administered daily for from five to seven days. Epilation was performed routinely in cases of grade 3 and grade 4 trachoma which had developed entropion.

Gallaher concludes that sulfanilamide therapy is not only of value but that its use is relatively safe; also, that in combination with other drugs it will produce improvement of the condition in 90 per cent of the cases of trachoma.

JOSHUA ZUCKERMAN, M.D.

Town, A. E.: Congenital Absence of Lacrimal Puncta in 3 Members of a Family. *Arch. Ophth.*, Chic., 1943, 29: 767.

The author reports congenital absence of the lacrimal puncta in 3 members of a family—a father and 2 siblings. He points out that only 21 cases of this condition have been reported in the literature. Moreover, there have been no previous reports of its occurrence in more than 1 member of a family.

In the father's case both upper puncta were absent; a slit had been made in the lower punctum in 1923 and the lacrimal sac had been removed in 1934.

The history of 1 child revealed recurrent swelling of the lacrimal sacs which had required incision at various times since birth. Lacrimal fistulas were

present in both eyes. In the right eye the lower punctum was absent and in the left eye the upper punctum was absent. The lacrimal sacs were excised.

In the second child both upper puncta were absent. Both lacrimal sacs were excised.

In all 3 cases slight epiphora persisted after excision of the lacrimal sacs but the infectious processes cleared up. JOSHUA ZUCKERMAN, M.D.

Thygeson, P., and Braley, A. E.: Local Therapy of Catarrhal Conjunctivitis with Sulfonamide Compounds. *Arch. Ophth.*, Chic., 1943, 29: 760.

The authors report their results from the local treatment of a series of 512 cases of acute and chronic conjunctivitis with sulfonamide compounds.

Sulfathiazole ointment (5 per cent) was found effective in the treatment of acute catarrhal conjunctivitis of bacterial origin especially of the staphylococcal variety and in chronic conjunctivitis resulting from the staphylococcus aureus and diplobacillus occurring alone or in association with other conjunctival pathogens.

The authors also report that cases of staphylococcal and diplobacillary conjunctivitis which did not respond to treatment with zinc-sulfate solution responded readily to sulfathiazole ointment, but cases of chronic conjunctivitis without bacteriological pathogens did not respond to local sulfonamide therapy. JOSHUA ZUCKERMAN, M.D.

Klien, B. A.: Anticoagulant Therapy of Occlusion of the Central Vein of the Retina in Relation to the Pathogenesis and Differential Diagnosis. *Arch. Ophth.*, Chic., 1943, 29: 699.

Attention is called to the four types of pathological changes leading to occlusion of the central vein of the retina. This is worthy of emphasis since all types are not equally amenable to heparin therapy. As described by the author with illustrative case reports these four types are as follows:

1. Cases of occlusion from compression from without the vessel and secondary thrombus formation. This type is most frequently on the basis of systemic arteriosclerosis. The lumen of the vein is gradually narrowed by compression and when completely closed at one or more points an irritative proliferation of the endothelium and of the subendothelial layers takes place, which accelerates the venous occlusion. This same type of occlusion may occur in tumor metastasis into the optic nerve. Since the thrombus formation is only the terminal event bringing about complete occlusion of an already narrow venous aperture, anticoagulant therapy is of little or no value.

2. Cases in which a thrombus is formed as a result of blood dyscrasias, such as polycythemia and thrombocythemia. In these cases heparin therapy is of very definite value. The initial action of the heparin may be prolonged and supported later, if necessary, by roentgen irradiation of the bone marrow.

3. Cases of stagnation thrombosis following widespread arterial spasm. This may occur in early spastic hypertension, surgical procedures, cranial fractures, or congenital heart disease. Anticoagulant therapy should be of definite value in the treatment of cases falling into this group.

4. Cases of occlusion secondary to inflammatory changes of the venous wall. The commonest cause of this is tuberculous retinal periphlebitis. The changes in the venous wall may either be of a nonspecific inflammatory nature or occasionally consist of real tuberculous granulation tissue. The use of anticoagulants is definitely contraindicated.

It may therefore be seen that an accurate clinical diagnosis of the type of occlusion present is important prior to considering the use of anticoagulant therapy. It is recommended that there be a thorough search for angioneurotic tendencies in the family and evidence of vascular disease. A complete hematological study should include the number and shape of the platelets and of the megakaryocytes, obtained by sternal puncture if indicated, as well as determination of the calcium, globulin, fibrinogen, and prothrombin levels as an indication of thrombotic tendencies. WILLIAM A. MANN, M.D.

EAR

Farrior, J. B.: Histopathological Considerations in Treatment of the Eustachian Tube. *Arch. Otolar.*, Chic., 1943, 37: 609.

The basis of this study is the microscopic examination of 100 histological sections of the eustachian tubes removed at autopsy. In each case the right eustachian tube was sectioned transversely at intervals of 4 mm. and the left tube longitudinally. The specimens included tissue from normal eustachian tubes as well as tissue revealing the respective inflammatory processes.

Histopathological changes in the eustachian tube are presented for acute catarrhal inflammation, acute purulent inflammation, acute suppurative inflammation, chronic catarrhal inflammation, and the inflammatory process produced by trauma, as well as the histopathological changes occurring in aero-otitis media.

The effects of chemotherapy on the eustachian tube and the lymphoid response to inflammation are discussed.

In conclusion, the author states that catheterization of the eustachian tube should not be done as a therapeutic measure in the presence of any active inflammatory process, as the resulting trauma promotes the formation of scar tissue. Catheterization of the eustachian tube should be done only as a diagnostic procedure or in the treatment of cicatricial narrowing of the eustachian tube when the histopathological changes are irreversible.

JOHN F. DELPH, M.D.

Perlman, H. B.: Lesions of the Conduction Apparatus. *Arch. Otolar.*, Chic., 1943, 37: 680.

The old teaching that loss of hearing acuity for low frequencies means a conduction lesion, and loss

for high frequencies a nerve lesion is found to be incorrect from experiences with the audiometer, tuning fork tests, and loudness balance studies. Otologists are confronted with the fact that it is difficult to predict the audiogram by objective examination of the ear because it is not known what the various components of the conducting apparatus contribute to the hearing curve and how this is altered by disease. Conversely, one cannot look at an abnormal audiogram and accurately define the lesion in the conducting apparatus which is producing it. This lack of knowledge interferes with the development of rational treatment directed toward conservation or improvement of function.

Perlman has gathered information in the clinic and laboratory with a good audiometer which is readily applicable to the problems encountered by the clinical otologist. He describes what the conduction apparatus contributes to the normal threshold curve by observing how this curve is altered when specific lesions are made. This article should be read in the original. NOAH D. FABRICANT, M.D.

Pohlman, A. G.: The Diaphragm-Rod Prosthesis for the Middle Ear. *Arch. Otolar.*, Chic., 1943, 37: 628.

This article deals with a diaphragm-rod prosthesis to be used in cases in which the drum membrane and the outer ossicles have been removed, the ear is dry, the external part normally wide, and the proper contact area for the rod accessible. This contact area must be sufficiently yielding to accept the vibrations of the prosthesis—a condition which may readily be established with the acoustic probe. Useful hearing may be conferred upon practically all patients under the conditions noted.

The diaphragm-rod prosthesis has little effect on the sensitivity for low tones and may increase the sensitivity in the important range frequencies from 512 to 4,096 by as much as 30 decibels.

The prosthesis is contraindicated for patients with discharging ears. JOHN F. DELPH, M.D.

NOSE AND SINUSES

Aufricht, G.: A Few Hints and Surgical Details in Rhinoplasty. *Laryngoscope*, 1943, 53: 317.

Prior to deciding the advisability of a correction, the surgeon must establish the normal physiology or the absence of pathology and evaluate the patient's mental attitude toward his deformity. If the extent of the deformity is out of proportion to the sensitiveness toward it caution should be observed.

Satisfactory results will depend not only upon the proper technical approach, but upon the possession of a definite esthetic sense by the surgeon in order to decide the extent of the desired change.

Photographic records are routinely made in eight views: front, both profiles, and one nostril picture from beneath, one set with the patient in repose, and one set smiling. The laughing pictures are important since the deformity may be obvious only then. Identical lighting conditions are essential for the before and after pictures, and neither film nor print should be retouched. By means of simple diagrams on the skin of the patient with mercurochrome or methylene blue at the beginning of the operation, the procedure to be followed is mapped out. The dimensions are memorized before the operation.

A new method of narrowing the bony dorsum after removal of a large hump is described. Rather than infracture of the bony sides of the nose after the frontal processes are sawed from the maxilla as is commonly done, the walls are fractured in the reverse direction—outward. The bony connection at the radix is divided, and the bony web from within the dorsum is removed, as well as a corresponding segment from the radix when necessary. Either the scissors, an osteotome, or a chisel may be used to cut through the remnant of the bridge and the radix nasi, and the bony wall is forced outward in one piece. By removal of the web from between the nasal bones, the bony sides of the nose will come together without leaving the wide dorsum which formerly was a problem.

A surgical procedure is described for the shaping of the nostril and the alar attachment. By the excision of a great variety of geometrical forms—the base of the nostril, the attachment of the ala, or the ala itself—practically all related deformities can be corrected. The direction of the ala may be changed; an inverted ala can be everted and, vice versa, a hanging ala can be raised, or a high ala can be lowered. The possibilities are infinite.

A method for overcoming the sharp pointed nasal tip is described. It consists essentially in freeing the lower lateral cartilages and dividing each at the highest point. Then a short anterior segment is divided near the anterior extremity of each crus, which leaves the segment attached to the underlying skin. These mobile segments will bend so that the convexity of the normal arch may be attained. The position is assured by vaseline gauze packing.

In cases of absence of a nasolabial angle, a method of subcutaneous suturing is described which avoids scar formation at the base of the columella. After removal of part of the inferior nasal spine and a portion of the protruding septal cartilage, a submerging suture is used to maintain the nasolabial angle. The position of the parts is assured by the use of Scotch tape over the tip. The transparent tape permits observation of the skin and position of the parts.

Vaseline packing is used in the nose after operation and is retained for several days. Discomfort is avoided by applying the packing around rubber or metal tubes for ventilation. JOHN R. LINDSAY, M.D.

MOUTH

Bigelow, H. M.: Vitallium Bone Screws and Appliances for Treatment of Fracture of the Mandible. *J. Oral Surg.*, 1943, 1: 131.

In the treatment of mandibular fractures, when arch wires, bands, and splints cannot be used, the

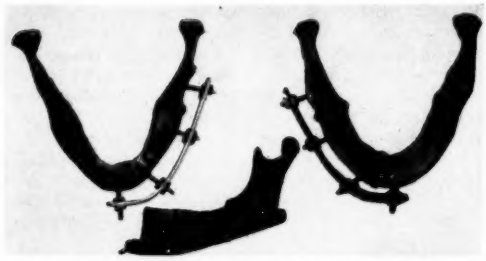

Fig. 1. Occlusal, lateral, and submandibular views of vitallium screws and external strap iron or dural splint.

Fig. 2. Retouched photographs of patient, showing wire fixation from vitallium screws to headcap appliance.

employment of vitallium screws inserted extraorally, either alone or in conjunction with a dural strap (Fig. 1) or headcap appliance with wire fixation (Fig. 2), will give satisfactory results with very minor surgical procedures.

To insert the vitallium screws, an incision is made through the skin over the desired area of the inferior border of the mandible. A bone drill small enough to allow full-sized threads is passed into the mandible for a depth of at least one-fourth inch. Care should be taken that the drill does not pass into the oral cavity. The use of this appliance inside the mouth is strongly discouraged because of technical difficulties and infection around the screws.

In general, the types of fractures requiring this treatment are those of edentulous mandibles and fractures posterior from the teeth. These may be third molars or any other teeth such as cuspids or biscuspids. LOUIS T. BYARS, M.D.

Kent, B. S.: Necrotic Gingivitis. *Lancet*, Lond., 1943, 244: 642.

Seventy cases of necrotic gingivitis occurring among men in military service are differentiated into two types, namely: latent scorbutus scurvy, and Vincent's ulceromembranous gingivitis. The possibility of mistaking one for the other is pointed out. The correct interpretation of smears is practically the only certain means of accurate diagnosis. Both spirochetes and the fusiform bacilli must be present to establish the existence of Vincent's disease. A history of hypovitaminosis C is given in relation to both of these diseases, and it was found that this was apparently the result of poor food preparation in the camp kitchens.

The clinical aspects and the methods followed in making this investigation are described and the results of the treatment of 6 arbitrarily chosen groups are given in detail. Local treatment alone is said to be insufficient, especially in medium and severe cases. In the latter type, mapharsen used locally, intravenously, or in combination, is said to be required for a high degree of success. Daily supplemental treatment with Vitamin C is very strongly recommended for the prevention of these gingival conditions. WILLIAM G. SKILLEN, D.D.S.

Stuhl, F.: Vitamin C Subnutrition in Gingivostomatitis. *Lancet*, Lond., 1943, 244: 640.

A study comprising 74 military patients suffering from gingivostomatitis showed the large majority to be deficient in Vitamin C, and although the exact relationship of the deficiency to the disease was not ascertained, it was believed that it was of sufficient importance to merit further study. This nutritional defect was traced to the poor preparation of food in the camp kitchens.

Case histories with clinical findings, laboratory technique, and the treatment are given. It is stated that the local treatment is enhanced when supplemented with Vitamin C.

WILLIAM G. SKILLEN, D.D.S.

NECK

Simon, M. M.: Recurrent Laryngeal Nerve in Thyroid Surgery. Triangle for Its Recognition and Protection. *Am. J. Surg.*, 1943, 60: 212.

Many thyroid surgeons prefer to demonstrate the recurrent laryngeal nerves as a preliminary step to the removal of each lobe of the thyroid gland. This is another application of the surgical axiom "to see is to save." To accomplish this step in thyroid surgery requires anatomic dissection with good exposure.

The author has described a relationship of the recurrent laryngeal nerve, the inferior thyroid artery, and the common carotid artery. These structures consistently form a triangle. The nerve forms the inverted base of the triangle, while the two arteries form the other two boundaries. The recurrent laryngeal nerve is flattened, firm, somewhat smaller than the diameter of a match, and white in color. It runs obliquely toward the trachea against which it can be palpated. It crosses usually behind, sometimes in front of the inferior thyroid artery, and occasionally between its branches. The common carotid artery is easily identified by its size, its location in the carotid sheath, and its pulsation. The inferior thyroid artery, a branch of the thyrocervical trunk, approaches the posterolateral surface of the

thyroid lobe coming from behind the carotid sheath and entering the gland at the level of the cricoid cartilage and carotid tubercle of the cervical spine. These three structures thus produce the before-mentioned triangle. After passing cephalad to the inferior thyroid artery the recurrent laryngeal nerve becomes intralaryngeal by passing under the lowest fibers of the inferior constrictor muscle—at the level of the cricothyroid articulation. Thus the nerve can be injured by clamping small bleeding vessels in this area; however, most injuries occur in the vicinity of the inferior thyroid artery.

Under local anesthesia the author exposes the thyroid gland. The superior pole is doubly ligated and severed. The middle and inferior thyroid veins are ligated and detached, then the lateral lobe is dislocated and rotated medially from its bed. With the lobe elevated and rotated medially and the contents of the carotid sheath retracted laterally with a blunt retractor, the loose areolar tissue between this structure and the trachea is exposed. In this area the trunk of the inferior thyroid artery can be felt and seen emerging from beneath the common carotid artery at the level of the cricoid cartilage (this location is constant). After exposure of the inferior thyroid the course of the recurrent nerve forming the third side of the triangle can be visualized, and thus preserved when the inferior thyroid artery is ligated and cut. EARL O. LATIMER, M.D.

Jackson, C. L., and Blady, J. V.: Criteria for the Selection of Treatment of Cancer of the Larynx. *Arch. Otolar.*, Chic., 1943, 37: 672.

The choice of laryngofissure, laryngectomy, or irradiation in the treatment of cancer of the larynx must be based primarily on the prospect of cure, and secondarily on conservation of function. The criteria of Jackson and Blady for the selection of treatment in a given case are: (1) the presence or absence of cervical metastases, (2) the location and extent of the lesion, (3) the motility and mobility of the cord, (4) the histological character of the lesion, and (5) the general condition of the patient.

Some of the decisions in the selection of treatment are easy to make. For example, the indications for laryngofissure are now fairly clear-cut and well established. On the other hand, it is admittedly difficult to establish an arbitrary basis for choosing between laryngectomy and irradiation. In this article an attempt is made by the authors to state the pertinent facts gleaned from their extensive experience with these problems. NOAH D. FABRICANT, M.D.

Jackson, C. L., and Norris, C. M.: The Surgical Treatment of Cancer of the Larynx. *Pennsylvania M. J.*, 1943, 46: 822.

It must be admitted that surgical treatment has shown the best statistical results in the treatment of cancer of the larynx, but there certainly are cases in which the patient may be allowed to choose irradiation instead of surgery, or in which the laryngologist may even be justified in advising irradiation.

The authors believe that "grading" should be taken into consideration in the selection of treatment and especially in prognosis, because the less differentiated, "higher grade" tumors are to be regarded as having a poorer prognosis regardless of the method of treatment.

The authors suggest the following surgical indications:

1. Lesions occupying the middle third of one vocal cord are suitable for the operation of laryngofissure by the "clipping" technique, regardless of the histological character or grading.

2. Lesions reaching the anterior commissure and involving even the opposite cord are amenable to extirpation by the laryngofissure route also, but in such cases the Chevalier Jackson "anterior commissure" technique should be used. The histological character may possibly influence the surgeon in deciding between the "clipping" operation and this technique, or between the "anterior commissure" operation and total laryngectomy.

3. Lesions in which the growth is cordal, but has reached the posterior end of the cord and produced impairment of motility, or has extended subglottically, call for total laryngectomy, regardless of their histological character. If the motility is unimpaired, irradiation may be used.

4. Lesions involving the ventricles, the ventricular bands, or the base of the epiglottis may be treated by either laryngectomy or irradiation.

According to the authors' statistics, the lesions of grade III give a better prognosis when treated surgically, whereas the lesions of grade II give a slightly better prognosis when treated by irradiation. However, the authors still are inclined to favor surgery in all cases of good operative risk, regardless of grading, and especially in the grade III cases.

When the lesions are located and extend in such a manner as to make the decision between laryngofissure and laryngectomy difficult, the higher the grade the more radical should the surgery be. Laryngectomy and partial pharyngectomy are done also in cases in which the lesion is "extrinsic," but the results in these cases are very unsatisfactory, and it is probable that irradiation would accomplish as much in arresting the growth and prolonging life. On the other hand, in some of the extensive cases, especially in those with cartilage involvement or perichondritis, there may be some advantage in removing the larynx preliminarily, and then following immediately with intensive irradiation.

While the presence of node metastasis in the neck contraindicates surgical intervention in the form of laryngofissure or total laryngectomy, it calls urgently for neck dissection and radon implantation, preceded by a full series of protracted fractional irradiation. If the irradiation is not immediately followed by this surgical procedure, the patient is almost certainly doomed.

The authors describe their technique of laryngofissure and laryngectomy and summarize their experience in a series of 30 consecutive cases in which they

have done laryngectomies by a "narrow-field" technique during a period of about two years, without operative mortality or serious complication.

JOSEPH K. NARAT, M.D.

Gatewood, E. T.: Development of Esophageal Speech after Laryngectomy. *South. M. J.*, 1943, 36: 453.

The surgeon is obligated to aid and encourage the laryngectomized patient to develop some form of communication by which he may be understood. Total and sudden loss of voice is a very disturbing mental factor unless the patient can be reassured that he has a reasonable chance of acquiring some new form of understandable speech.

The artificial larynx is used occasionally with success, but it attracts attention because of the unnatural stentorian quality of the sound. The artificial larynx should be reserved for those who cannot or will not learn the mechanism of esophageal speech.

Esophageal speech has the advantage of producing a favorable psychological effect upon the patient. Practice is begun from six to eight weeks after surgery. Before and during the period of training it is necessary to develop an attitude of optimism and complete confidence in the patient. The pulmonary air now takes no part in the production of voice. Occasionally some difficulty arises from inability to dissociate the usual respiratory movements from his speech efforts.

The mechanism depends primarily upon the act of swallowing air and using it under voluntary control so that the sphincteric esophageal constriction at the hypopharynx is used to produce the tone vibrations. When feasible, close dissection of the larynx is desirable to conserve the nerve supply to this region of the esophagus.

Variations in technique are common. Some patients swallow air in large gulps while others inspirate small quantities of air into the upper esophagus, frequently. Posturing of the head and neck and certain muscle rigidities may help. Beginners are taught to close the tracheal opening with the finger and inspire air into the throat during the attempted act of chest expansion, and then to control this in association with the formation of letters, syllables, words, and sentences.

A laryngectomized person with esophageal speech can be of great assistance in inspiring confidence in the beginner.

JOHN R. LINDSAY, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Pickles, W.: Compound Fractures of the Skull. *N. England J. M.*, 1943, 228: 413.

The author presents a report of the treatment of 104 cases of compound fracture of the skull at the Rhode Island Hospital, Providence, Rhode Island. Two per cent of the patients had suffered concussion, 24 per cent had congestion, and 74 per cent showed evidence of contusion. In only 2 patients were there no signs of brain damage. Although confirmatory x-ray diagnosis of fracture is most useful in cases in which the condition of the patient permits it, the roentgenogram had failed to demonstrate several cases found at operation.

Of 66 cases of basal fracture, 49 had damage of the petromastoid region. The diagnosis was made on the basis of one or several of the following findings: (1) bleeding from the ear not otherwise explained, (2) blood in the middle ear behind an intact membrane, (3) drainage of cerebrospinal fluid, (4) bleeding from the pharynx not otherwise explained, and (5) x-ray evidence.

Since many of the patients were in shock, treatment for shock necessarily had precedence over treatment of the fracture. The most reliable forerunner of shock is a subnormal temperature. The blood pressure was well maintained until the patients went into severe shock.

Bleeding or drainage from the orifices was not disturbed until late in the course of treatment. Any therapy, such as dehydration or lumbar puncture, which might change the cerebrospinal dynamics was deferred for a period of at least ten days after all discharge had ceased. Not less than 2,500 cc. of fluid was given daily.

Cerebrospinal rhinorrhea occurred in the cases of 5 patients, only 1 of whom died of severe brain damage within two hours. All cases were treated conservatively; there were no infections, and drainage lasted for a period of from three to twelve days.

Antral fractures occurred in 10 cases. All were of the closed type, and all were treated conservatively. Because of the possibility that these fractures extended into nearby basal areas, lumbar puncture was withheld for a period of ten days. There were no infections or deaths.

In the case of frontal sinus injuries, the closed type of fracture was treated conservatively. Open fractures were débrided and closed, and penetrations of the cavity, which often involve the dura and brain, were operated upon by the least extensive procedure. Following débridement, gloves and instruments were changed, extensive saline flushing was done, and all loose bone fragments, with the exception of those involving the supraorbital ridge, were removed. The posterior wall was not removed routinely, nor was the entire mucous lining removed. In cases in which the mucous lining was not greatly damaged and in which good drainage through the frontonasal duct could be obtained, the mucous lining was sutured. Infection was present in only 1 of 11 cases. Five patients were treated by the forbidden external drainage, but in no case did infection or fistula develop. There were no deaths.

Compound fractures of the vault were treated by the usual methods developed by Cushing. Sulfonamides were not used in wounds unless, for some reason, operation had to be delayed. In these cases sulfonamide powder was simply dusted into the wound and removed at the time of operation. Drainage was not required and there were no wound infections. However, meningitis developed in 2 cases.

JACK I. WOOLF, M.D.

Munro, D.: The Late Effects of Craniocerebral Injuries. *Ann. Surg.*, 1943, 117: 544.

It is high time that someone made a direct attempt to discuss the problems involved in head injuries and their possible legal significance. As the author of this article says, the relationship between an injury, or even a possible injury, and the symptoms and signs said to be organic and those said to be functional, is in a chaotic state. The various inadequacies of eventual legal conclusions are pointed out, and the semi-philosophical introduction to the statistical study is of great interest.

The study consists of an analysis of 50 patients injured in industry and seen and studied by the author during the past eighteen months as an impartial examiner for an industrial accident board. Although the series is small, there is certainly unity of direction and unity of purpose in the analysis. The series consisted of 8 female and 42 male patients. The interval between the date of the injury and the time of the first examination was known in 49 instances. Five classifications were made: cases in which the cause of the symptoms was believed to be organic and certainly directly related to the alleged accident; cases in a post-traumatic state, in which the cause of the symptoms was believed to lie in the nonorganic spheres and to be not necessarily directly related to the alleged accident; cases with intercurrent disease, in which the cause of the symptoms was attributed to intercurrent disease with no relationship to the alleged accident; cases with no disease, in which the symptoms and signs were of such character that no disease was believed to have been present at the time of the examination; and cases with a double diagnosis, in which two diseased conditions were believed to be present simultaneously.

In the first place, there has to be verification of the injury and this is of more judicial than medical interest. However, local objective evidence may be extremely difficult to obtain. This is true particu-

larly of fractures in the vault of the skull. A linear fracture may be taken as evidence of injury to the skull, but in some cases it is quite impossible to regard a linear fracture of the skull, in itself, as responsible for the symptoms and signs of which a patient may complain many months after the injury. Next, the intracranial effect of the injury must be taken into consideration, and here the loss of consciousness as a result of the injury must be demonstrated. Retrograde amnesia, if present, is pathognomonic of a loss of consciousness; in syncope there is no retrograde amnesia.

The article goes rather carefully into the question of amnesia and quotes several interesting incidences of patients with amnesia who were never unconscious and who had periods or islands of consciousness following an accident. It seemed reasonable then to conclude that unconsciousness at the time of the injury indicated intracranial pathology. On the other hand, lack of unconsciousness at the time of the injury does not mean that the symptoms complained of cannot be present. Objective signs and symptoms consisted of wounds, neurological signs, convulsions, and loss of memory.

Subjective symptomatology that is allegedly the cause of late disability in craniocerebral injuries is legion. The possible causes are headache, insomnia, and dizziness, and they are fully evaluated. Pending legislation is also discussed in relation to its effect upon the patient.

The discussion of the classification of the disability is extremely interesting and of the 15 patients who were classified, all having organic disease related to the injury, 12 were hospitalized before any definite opinion was given. In several of the post-traumatic group, it was felt necessary to put in bilateral burr holes before organic disease was ruled out. Double diagnosis was made in 4 patients of the 50 and in every case the intercurrent disease was vascular, arteriosclerosis with hypertension or hypertension alone. The patients with no disease were usually patients desiring to return to work and requiring medical examination before so doing.

ADRIEN VERBRUGGHEN, M.D.

Siris, J. H.: The Utilization of Encephalomyopexy in Selected Cases of Post-Traumatic Focal Epilepsy. *Surgery*, 1943, 13: 653.

Five cases of focal epilepsy were treated by encephalomyopexy to augment the circulation of the cerebral cortex. In order to effect vascular anastomosis between the cortex and overlying muscle in the absence of intracranial hypertension, the intervening arachnoid must be eliminated. This was accomplished by lightly cauterizing the superficial portions of some of the more prominent exposed convolutions. To avoid leaving a sizable bony defect the scalp and muscle flaps were reflected separately and the underlying bone area removed en bloc. An opening was made at the base of the bone flap just large enough to allow for the entry of muscle without constriction, and the bone flap was wired in place. Mastication is unimpaired by the removal of the temporal muscle from its skull attachment, and the act of mastication has no untoward effect upon the patient. The contour of the temporal region is not visibly altered.

In the selection of patients for this operation only those whose convulsive manifestations were consistently focal or related to a local lesion, such as that following injury or former infection, were considered suitable. Operation was not performed if the seizures were adequately controlled with medication. Of the 5 patients operated upon, 3 have not been subject to recurrences of seizures from five to seven months later. These patients all had focal manifestations corresponding to a gross post-traumatic cerebral lesion of a cystic degenerative nature.

In the remaining 2 patients the frequency and intensity of paroxysms have diminished appreciably. The postoperative medication was maintained as close as possible to that which failed to control seizures preoperatively. Operation was well tolerated in every instance and resulted in no observed impairment of function.

The question arises as to whether myopexy does not substitute one epileptogenic scar for another. It appears probable that the scar about the muscle graft is different from ordinary atrophic epileptogenic scar because of its vascularity.

JOHN L. LINDQUIST, M.D.

Hamby, W. B.: Trigeminal Neuralgia Due to Radicular Lesions. *Arch. Surg.*, 1943, 46: 555.

It is generally held that an organic lesion of the trigeminal pathways produces pain associated with sensory changes and, therefore, is not easily mistaken for major trigeminal neuralgia. This is not always true, since a survey of the literature shows that a lesion affecting the trigeminal system in one of several places may produce pain indistinguishable from that of tic douloureux. A discussion of the following locations of lesions producing trigeminal pain is presented: (1) peripheral branch of nerve or gasserian ganglion; (2) sensory root; (3) central sensory pathways.

While a tumor compressing a peripheral branch or the ganglion of the trigeminal nerve may produce ticlike pain, there is usually also a steady background pain and sensory loss. Compression of the sensory root of the nerve by a tumor of the cerebellopontile angle may produce pain and sensory loss indistinguishable from symptoms caused by a tumor of the middle fossa, but involvement of neighboring nerve roots usually permits differentiation. A lesion involving the trigeminal pathways in the temporal fossa or in the cerebellopontile angle may produce pain indistinguishable from that of major trigeminal neuralgia. Such lesions are more numerous in the posterior than in the middle fossa. Differentiating signs will appear later but may be absent at the time of examination and operation. Tic pain due to a lesion of either the middle or posterior fossa is relieved by the injection of alcohol or by section of the

sensory root of the trigeminal nerve. Section of the sensory root by either the temporal or cerebellar approach will relieve trigeminal pain, whether it originates peripheral or central to the gasserian ganglion.

The author prefers the temporal approach to the root in uncomplicated cases of tic douloureux. However, patients with tic douloureux are examined carefully for signs of a lesion in the posterior fossa. If any doubt exists, the rhizotomy is done via the posterior fossa. Patients younger than the average also should have the posterior approach. The author used the cerebellar approach in 9 cases in a series of 109 operations for trigeminal neuralgia. In 2 of the 9 cases a pearly tumor (epidermoid) of the cerebellopontile angle was found. Four case reports of operations by the posterior approach are presented. In 1 of these patients a temporal section was planned. On the morning of operation the patient experienced vertigo, tinnitus, and emesis with nystagmus, and diminished corneal reflex for the first time. Exploration of the cerebellopontile angle revealed a pearly tumor. JOHN L. LINDQUIST, M.D.

SPINAL CORD AND ITS COVERINGS

Semmes, R. E., and Murphey, F.: The Syndrome of Unilateral Rupture of the Sixth Cervical Intervertebral Disc with Compression of the Seventh Cervical Nerve Root. *J. Am. M. Ass.*, 1943, 121: 1209.

This is an analysis of 4 cases of unilateral rupture of the sixth intervertebral disc with compression of the seventh cervical nerve root seen by the authors, 3 of which were operated on and the fourth of which was included in the series on account of the completeness of the syndrome. Discussions of this symptom complex have appeared in the literature from time to time, but so far, no discussion so clear as this has been forthcoming. Herniated discs in the lumbar region are, of course, exceedingly common, and herniated discs in the cervical region are probably very much more common than supposed. It would be interesting to know how many cases of what was hitherto regarded as the scalenus anterior syndrome have really been due to a ruptured disc between the lower cervical vertbrae. Another common mistake made in the diagnosis in these cases is to mistake the precordial pain, so common in these instances, for coronary disease. The herniation usually takes place either above or below the sixth cervical vertebra, thus affecting either the sixth or seventh cervical nerve.

Patients usually complain of numerous cricks in the neck recurring intermittently for months or years. Finally, there is a particularly severe crick with disabling pain which radiates in three general directions—down the lateral and medial surfaces of the arm, over the chest to the precordium, and down the back just medial to the upper angle of the scapula. As a rule there is difficulty in breathing and the pain may be intense. The pain is intensified by moving the neck or coughing and sneezing. There is some definite numbness and weakness in the index finger and slight numbness in the middle finger. Severe shoulder spasm is seen, and the neck is held rigidly. A tender point over the exit of the seventh cervical nerve is noted just posterior to the scalenus anterior muscle. There is a definite hypesthesia of the index finger. No reflex changes are noted, nor is there evidence of muscular atrophy. X-rays of the spine show a straightening of the cervical curve, and occasionally a narrowed space may be seen. The total protein may be increased or may be normal, and the dynamics of the fluid is normal. No contrast media are necessary, as far as the authors are concerned, in the diagnosis of these cases for diagnosis is based entirely on the history and physical findings.

The operative procedure was carried out under local anesthesia and the involved nerve root was identified by pressure on the ligamentum flavum which reproduced the exact pain. A small portion of the adjacent laminas and ligamentum flavum is removed to expose and take out the disc. The patients received prompt and sustained relief.

A clear history of each of the 4 cases is appended. This article is a landmark in the progress of neurological surgery, and the information obtained from it, if intelligently applied, should lead to proper diagnosis and relief for patients hitherto unsuccessfully treated. ADRIEN VERBRUGGHEN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Wilson, J. V.: The Pathology of Closed Injuries of the Chest. *Brit. M. J.*, 1943, 1: 470.

The injuries of the chest reviewed by the author are divided into two main categories, those due to direct violence to the chest and those in which the injury to the thoracic viscera is indirect. In the first group, lacerations, contusions, and blast injuries of the lung are considered, while in the second group pulmonary fat embolism is the condition discussed.

Lacerations. When large vessels or the heart were involved death occurred within a short time. However, when the periphery of the lung was the site of the injury the lesion was of more clinical interest and the complications resulting therefrom were of more importance than the lesion per se. These complications included hemothorax, collapse of the lung, and infection. The amount of bleeding was usually inconsequential and the degree of pneumothorax was variable. Bleeding from intercostal or mammary vessels, however, was more serious and at times fatal. Collapse of the lung may occur gradually and be insignificant until twelve or eighteen hours after the injury. At times it was extreme but usually it was moderate in degree. Infection of the pleural space is still prevalent in spite of sulfonamide therapy and occurs usually late in the course of the condition.

Contusions. This type of injury involved either the lung or the heart and produced hemorrhages within those structures. At times this was followed by inflammatory reaction. However, this injury as a whole was less serious in its nature than lacerations.

Blast injuries are usually characterized by multiple hemorrhages scattered throughout the entire lung, both superficially and deep. At times they were extreme and produced marked intra-alveolar as well as intrabronchial hemorrhage. This interfered considerably with respiratory function. Four theories were advanced as to the cause of death in these patients: (1) pulmonary hemorrhages with interference with respiratory function, (2) cerebral death, (3) cardiac death with ventricular fibrillation as the chief factor, and (4) air embolism.

Pulmonary fat embolism. This lesion is usually secondary to multiple fractures, especially of the long bones, the fat gaining entrance to the blood stream and thence being directed to the lung. The chief microscopic lung findings are hemorrhage and mild edema although in some cases large subpleural hemorrhages occur. WILLIAM E. ADAMS, M.D.

McKinley, D.: Chronic Cystic Mastitis and Carcinoma. *West. J. Surg.*, 1943, 51: 234.

Considerable confusion exists in the literature of the past ten years and in the minds of clinicians regarding the management of chronic cystic mastitis. The problem has been made important by the apparent relationship of chronic cystic mastitis to carcinoma of the breast. Cheatle and Cutler assert that 20 per cent of the carcinomas of the breast are preceded by a pathological process which they have designated as cystiferous desquamative epithelial hyperplasia, manifested clinically as one phase of chronic cystic mastitis. In mazoplasia there is both an epithelial proliferation and a connective-tissue proliferation, but the latter predominates. Cystiferous desquamative epithelial hyperplasia is predominantly a proliferation of the epithelium. In mazoplasia there is acinar proliferation. In cystiferous desquamative epithelial hyperplasia, this does not occur; there is only proliferation of acinar epithelium, without the formation of new acini.

The clinician's problem is to know what percentage of chronic cystic mastitis will terminate as carcinoma. The author examined the records of 60 cases of chronic cystic mastitis (pathologically diagnosed cases of mazoplasia not included) seen in the University of Oregon Medical School's Outpatient Clinic and in the Multnomah County Hospital, Portland, Oregon. The cases were those observed in the ten-year period from 1932 to 1942, in which the diagnosis had been recorded as cystic disease of the breast or chronic mastitis, cause unknown. There may have been additional cases in which the diagnosis could have been made, or was made and not adequately recorded. Inasmuch as the number of cases analyzed is small and the period of follow-up so short, it is not at all surprising or significant that none of this group has been observed to develop a carcinoma.

In addition to the records of chronic mastitis cases, records from the Tumor Clinic were examined. Twenty-three per cent of 128 pathology reports of breast carcinoma contained an associated diagnosis of cystiferous desquamative epithelial hyperplasia, or implied such a diagnosis in the description of the tissues. In 4 per cent of these reports the origin of the carcinoma could be seen in papillomas or cystiferous desquamative epithelial hyperplasia.

The analysis of the cases of cystiferous desquamative epithelial hyperplasia or chronic cystic mastitis has not resulted in a satisfactory appraisal of the incidence of subsequent carcinoma. Reasons for the inability to draw conclusions are: (a) too small a series has been accumulated, (b) many of the cases in which the diagnosis was made clinically have not been pathologically confirmed, and (c) follow-up observation has been too infrequent and too short.

In regard to the management of an individual case of chronic cystic mastitis, it should be said that the attitude of Shields Warren would seem to be the most logical. Chronic cystic mastitis predisposes to cancer. It is impossible to tell clinically which case will or will not develop cancer. The risk is probably

not sufficiently great to warrant bilateral mastectomy in all cases, which procedure is desirable from the standpoint of the pathologist. Certainly, all localized masses in the breast should be excised and examined, but local excision will be followed by further symptoms in about 15 per cent of all cases, and will not insure against carcinoma present at the time of surgery or developing in the future. Hormonal therapy (or pregnancy) may be permissible in those under thirty years of age, with the realization that the results in the literature thus far seem equivocal. JOSEPH K. NARAT, M.D.

TRACHEA, LUNGS, AND PLEURA

Holinger, P. H.: Candy and Chewing Gum as Foreign Bodies in the Air Passages. *Laryngoscope*, 1943, 53: 312.

Hard candies, lozenges, or chewing gum aspirated into the larynx, trachea, or bronchi present specific foreign-body problems. Children constantly place candies in their mouths while playing, and aspiration can take place during the rapid respiration that accompanies childhood activity. Similarly, gum, so frequently present in the mouths of adults as well as of children, is chewed during all types of activity and inactivity. The adult who dozes with gum in his mouth or the child who goes to sleep with chewing gum in his mouth suggests the potential danger of this type of foreign body.

Holinger reviews 5 cases in which confections caused severe obstruction to the airway. A positive history with physical findings of laryngeal, tracheal, or bronchial obstruction establishes the diagnosis. Roentgen findings of bronchial obstruction or a peculiar patchy linear atelectasis are diagnostic aids. The possibility that some of the otherwise unexplained atelectases that occur in children may be due to the aspiration of hard candies while the child is playing must be considered.

NOAH D. FABRICANT, M.D.

Goorwitch, J.: Thorascopy in Pulmonary Tuberculosis. *J. Thorac. Surg.*, 1943, 12: 361.

This study was stimulated by a remark from a fellow physician in the course of a staff conference at the Olive View Sanatorium. The gist of the remark was that inasmuch as thoracoscopy was essentially a surgical procedure, it was not indicated in therapeutic pneumothorax in which pneumolysis was apparently not feasible, as judged by the appearance of the adhesions in the roentgenograms.

As pointed out by many workers, the only reliable method of determining the feasibility of closed pneumolysis is inspection of the adhesions in the course of thoracoscopy; roentgenography, though very helpful, is not without its limitations. Employing this concept as a starting point for further reasoning, it would seem inadequate therapy not to give the patient the benefit of thoracoscopy in instances in which pneumolysis does not seem to be entirely out of the question because of diffuse adherence, provided it can be demonstrated that thoracoscopy is free of serious accidents and complications.

In order to determine how safe thoracoscopy was, the records of all patients subjected to it without pneumolysis at Olive View Sanatorium were reviewed, particular attention being given to the type of complication and its time relation to the operation. The preoperative status, and the complications and developments following 73 thoracoscopies done by 5 successive operators over a period of about thirteen years are presented. Among all of the postoperative complications and developments observed, it appears that fever alone was directly attributable to thoracoscopy. Pleural effusion and obliterative pleuritis could possibly have been classified as true complications if it were not for the fact that their postoperative incidence, over a longer period of observation, was even lower than the preoperative incidence. Even if regarded as true complications, their incidence was not high, so that it must be conceded that thoracoscopy, although a surgical procedure, was free of serious accidents and complications in this series. The limitations of roentgenography in studying pleural effusions, despite its definite usefulness in most cases, has already been pointed out.

Once it has been demonstrated that thoracoscopy is safe and not replaceable by roentgenography, the obvious conclusion is that this procedure deserves a wider application in order to render ineffective collapse effective when pneumolysis is feasible, and to discontinue pneumothorax at an earlier date and substitute an effective procedure when pneumolysis is not feasible, before disastrous complications of ineffective pneumothorax supervene.

JOSEPH K. NARAT, M.D.

Churchill, E. D., and Klopstock, R.: Lobectomy for Pulmonary Tuberculosis. *Ann. Surg.*, 1943, 117: 641.

Six cases of pulmonary tuberculosis treated by lobectomy are presented. Three of the patients had the usual indications for lobectomy, while 3 were individuals in which thoracoplasty could have been expected to give good results. All patients recovered promptly without the development of bronchial fistula or empyema, or the spread of tuberculosis.

Lobectomy is presented as a more selective and rapid method of removing certain types of tuberculous lesions, that ordinarily might be controlled by pneumothorax or thoracoplasty. It preserves the function of the remaining lung tissue. It removes the offending lesion completely, although it must be borne in mind that lesions may be present elsewhere in the lung. Complications, such as spread of the tuberculosis, empyema, and bronchial fistula may occur if the usual sanatorium regimen is neglected.

Emphasis is placed on the removal of the involved lobe by dissection. It is possible to dissect interlobar fissures and avoid tourniquet lobectomies or total pneumonectomies in instances of unilobar tuberculosis.

A plea is made for an adequate trial of lobectomy in pulmonary tuberculosis as a further aid in the rehabilitation of this type of patient.

WILLIAM E. ADAMS, M.D.

Daniel, R. A., Jr., Billings, F. T., and Crutcher, R. R.: The Local Effect of Sulfanilamide, Sulfathiazole, and Sulfadiazine upon Hemolytic Staphylococcus-Aureus Infections of the Pleural Cavity. *Ann. Surg.*, 1943, 117: 670.

A short review is given of the experimental and clinical data available on the local use of sulfonamides in the pleural cavity.

Experimental observations on the treatment of hemolytic staphylococcus-aureus empyema in dogs are presented. Total pneumonectomies were done on a series of 12 dogs. Six animals were inoculated locally with twenty-four-hour broth cultures of hemolytic staphylococcus aureus as controls. These animals invariably died of empyema. Groups of six dogs were inoculated with the organism and 0.3 gm. of sulfonamide per kgm. of body weight. Sulfanilamide, sulfathiazole, and sulfadiazine were used locally in the pleural space following pneumonectomy. Five of 6 dogs treated with sulfanilamide died; 3 of 6 dogs treated with sulfadiazine died; all of the animals treated with sulfathiazole lived.

Evidence of inflammatory reaction followed only the use of sulfadiazine. Sulfadiazine absorbs more slowly than either sulfanilamide or sulfathiazole from the pleural cavity. There was some evidence that sulfathiazole may have interfered with wound healing, but it gave the most effective results.

WILLIAM E. ADAMS, M.D.

Ceballos, A., Bottini, A. C., and Escudero, E.: Total Pneumonectomy for Cancer of the Lung (Neumonectomia total por cáncer del pulmon). *Sem. méd.* B. Air., 1943, 50: 642.

The authors report a case of pulmonary carcinoma that was treated successfully by pneumonectomy. The patient was a fifty-year-old male who was diagnosed roentgenologically, and the cytological examination of the sputum revealed the presence of neoplastic cells. The case report included the operation and histopathology.

The contribution is particularly interesting in that the condition was discovered on a routine chest roentgenogram and when the patient came to operation he had no subjective evidence of pulmonary disease.

ROBERT LICH, JR., M.D.

ESOPHAGUS AND MEDIASTINUM

Aguilar, O. P., and Queirel, J.: Congenital Benign Tumor of the Posterior Mediastinum in Form of Cystic Fibromyxolipolymphangioma (Tumor benigno congenito de mediastino posterior a forma fibro-mixo-lipo-linfangioma quistico). *Rev. As. méd. argent.*, 1943, 57: 81.

The authors report a case of a mixed mesodermic tumor or so-called monodermoma in a thirty-eight-year-old Spanish woman.

When a tumor forms during the period of primary segmentation of blastomeres in an embryo, a teratoma or tridermoma results; if, however, a tumor develops in more advanced stages of embryonal life, its components may derive only from one germinal layer and are called monodermoma. In the authors' case the components of the tumor indicated their origin from the mesodermal germinal layer. The tumor contained connective tissue, lymph vessels, fat, cysts, and myxomatous tissue. The tumor was occupying the upper half of the left lung and produced a dullness over the involved region and abolition of the vocal vibrations. The roentgenogram showed an ovoid shadow in the left lung, adjoining the upper portion of the heart. Bronchography demonstrated a triangular arborization of the bronchus of the left upper lobe, with the base directed toward the anterior chest wall.

The preoperative diagnosis was: lymphogranuloma, lymphosarcoma, or a malignant bronchopulmonary neoplasm. An aneurysm of the aorta was also considered. The result of biological reactions and the patient's history excluded the diagnosis of an echinococcus cyst. Neither the clinical nor the roentgenological examination supported the diagnosis of a tuberculous lesion.

The tumor had the following dimensions: 10 by $15\frac{1}{8}$ by 8 cm.; its weight was 450 gm.

JOSEPH K. NARAT, M.D.

Dorsey, J. M.: Chronic Empyema Due to Dermoid Tumors of the Mediastinum. *Surgery*, 1943, 13: 755.

The causes of chronicity in empyema thoracis have been listed as: inadequate drainage, the presence of foreign bodies, communication with the lung, cavities that cannot be spontaneously obliterated, tuberculosis, or fungus infections. The author adds a sixth cause—dermoid tumors of the mediastinum.

It is only by carefully planned study that diagnosis of the underlying cause of chronic thoracic sinuses can be correctly made. In addition to thorough general physical examination, specific investigation of the thorax must be carried out. The sputum and sinus discharges should be searched for tubercle bacilli, as well as for fungi of all types. Culture is made of both, as well as a direct smear for hair, sebaceous material, cholesterin crystals, and epidermis. Guinea-pig inoculation is advised.

Dermoid tumors of the mediastinum are called epidermoids when derived from ectodermal elements, true dermoids when there is, in addition, evidence of mesodermal derivation, and teratomas when derivatives of all three germinal layers are present.

Characteristically, dermoids are found in the anterior mediastinum, extending laterally and posteriorly as they enlarge. A study, particularly of the lateral roentgenograms of the chest, in 2 cases, one that of a thirty-year-old woman and the other of a twenty-eight-year-old woman, showed the costovertebral gutter region to be free from disease. This is

usually involved in a chronic empyema process. Lipiodol visualization of the sinus tracts demonstrated their extension into the anterior mediastinum. This suggested the diagnosis of dermoid tumor, which was further substantiated in each case by material from the sinus which was characteristic of these lesions, such as hair and sebaceous material.

At operation in each instance a tumor was removed. Hair could be seen on both specimens. The derivatives of ectoderm and mesoderm could be seen on the microscopic section.

Secondary infection sometimes constitutes a deceiving as well as a dangerous complication of these neoplasms and leads to masking their presence behind the clinical syndrome of chronic empyema. Infection usually occurs from rupture into the neighboring pulmonary parenchyma or bronchi due to pressure. Suppurative pleurisy may result, which, even when adequately drained, will not be permanently cured because of the underlying pathological process.

The surgical approach to each patient must be individualized. While the transpleural operation through a posterolateral incision, as advocated by Harrington, affords the best exposure and thereby facilitates careful dissection from other mediastinal structures, the anterior approach may be safer in the presence of infection. Because of the malignant changes in at least 15 per cent of these tumors, early surgical removal is desired. JOSEPH K. NARAT, M.D.

MISCELLANEOUS

Smithy, H. G.: Traumatic Hemothorax with Special Reference to Chronic Persistent Types. *J. Thorac. Surg.*, 1943, 12: 338.

One of the commonest causes of intrapleural bleeding in civil practice is a closed wound of the chest, and persistent sterile hydrothorax may persist in a small group of these cases.

Among the Negroes in the South the weapon which is used to produce most of these lesions is the "switch blade" knife. Hemorrhage is usually from laceration of the lung itself but may also arise from the intercostal vessels or internal mammary vessels. There is usually an associated pneumothorax, the amount of pulmonary collapse being variable. In a small group of cases tension pneumothorax may develop, and cause apprehension, coughing, and possible cyanosis on the part of the patient.

During the acute phase of the condition conservative treatment is indicated, aspiration of the blood and replacement with air being the procedure of choice. Some authors have advised doing nothing, whereas others have advised removal of all of the blood early in the course of the condition. The author believes that two or three days after the injury most of the blood should be removed and replaced with air.

Statistics from 50 cases form the basis for the present report. The management of these patients was as follows: in 20, bed rest was instituted; in 8, thoracentesis alone was done; and in 13, thoracentesis with air replacement was done. Open thoracotomy was used in 4 patients and an exploratory thoracotomy with closure in 1 patient.

In the management of the chronic phase both conservative and radical methods may be used. Removal of the offending agents from the pleural cavity offers the only means of cure in patients showing marked thickening and loculation on x-ray examination. When infection is present treatment by open rib resection is indicated. Radical management includes complete evacuation of clots, fibrin, fluid, and friable bands. When no infection is present the wound should be closed completely without drainage following operation. WILLIAM E. ADAMS, M.D.

Freedman, P., Levine, S., and Solis-Cohen, L.: Hemothorax in Blood Dyscrasias. *Am. J. M. Sc.*, 1943, 205: 692.

The authors note that although the blood dyscrasias associated with an abnormal tendency toward bleeding, such as the purpuras, scurvy, and hemophilia, are usually mentioned as possible causes of nontraumatic hemothorax, case references in the literature are rare. Prior to 1900, there were 2 such references, but since that year there appears to have been no such cases described. Consequently it was deemed advisable by the authors to report 2 cases of hemothorax which were admitted to the Jewish Hospital in a period of two months. Both occurred in males; one was due to hemophilia, and one to thrombocytopenic purpura. There is a distinction to be made between true blood in the pleural cavity and a pleural effusion which is blood stained or hemorrhagic. The latter is not uncommon and is frequently seen accompanying malignant and lymphoblastomatous disease of the intrathoracic structures.

The case studies are presented in detail. Both patients were in the third decade of life and presented an abnormal bleeding tendency. In neither was the latter a primary manifestation of the disease. In the hemophiliac it was acute in clinical onset, while in the purpuric individual it was more insidious. As is indicated by the course in the former, it is not necessarily fatal. The extreme danger of infection which may be introduced from without is emphasized by the outcome in the latter. Therapy, as in all cases of hemothorax, is somewhat controversial. Certainly if the onset is accompanied by shock, that should be treated first. As the bleeding undoubtedly is diffuse and not focal in origin, there is probably never an indication for thoracotomy and vessel ligation.

Aspiration is usually indicated after about forty-eight hours, as blood left in the pleural cavity may form fibrin clots, the latter requiring thoracotomy. Replacement pneumothorax is probably of some value in certain cases to prevent a sudden change in intrapleural pressure but it is questionable if it is of any value in controlling bleeding. The authors believe it probable that it increases the tendency toward pleural adhesions with their serious consequences. HERBERT F. THURSTON, M.D.

Staffieri, D., Kruse, H. A., and Vila, O.: Spontaneous and Traumatic Hemopneumothorax. Cases (Hemoneumotorax espontaneo y traumatica. Causistica). *Rev. méd. Rosario,* 1943, 33: 244.

Three cases of spontaneous hemopneumothorax have occurred at the Rosario Hospital among a total of some 11,000 patients. These are described and illustrated with roentgenograms.

The first case was that of a man of twenty-eight years who after having climbed a stairway of about 20 steps suddenly had pain in the right shoulder and nipple followed by intense fatigue, sweating, and pallor. Examination at the hospital the next day showed the classical picture of right hydropneumothorax with the additional symptoms of slight cough and tachycardia. Puncture gave a red fluid containing blood cells. For thirty days the patient had a fever varying from 37° to 38.5° which was resolved by lysis. A month and a half after admission he left the hospital in good condition.

The second patient was a man of forty-five years who engaged in a struggle with an insane man who attacked him. The day after the next he had sudden pain in the left nipple and marked dyspnea. Clinical and roentgenological examination suggested spontaneous hemopneumothorax and puncture confirmed the diagnosis. Pleural puncture gave a fluid that resembled blood diluted to about one-third except that there was a high eosinophilia (33 per cent). The clinical and roentgen course was favorable during the entire month and a half of his stay in the hospital.

The third case was called traumatic as there was a direct injury to the thorax, a severe blow in the right dorsolumbar region which fractured several ribs. A few days later a pleural effusion developed at the right base and the roentgenogram showed the picture of hydropneumothorax. Puncture gave a hemorrhagic fluid. The course was satisfactory with total re-expansion of the lung.

Diagnosis was easy in these cases from the sudden beginning in healthy patients, the early improvement, and final recovery; the lack of any clinical, roentgen, or laboratory evidence of tubercle bacilli excludes tuberculous hemopneumothorax.

AUDREY G. MORGAN, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Pierini, A., and Giuliano, A.: Pancreatic Choleperitoneum and Biliary Pancreatic Peritonitis (Coleperitoneo pancreatico o peritonitis bilio-pancreatica). *Rev. As. méd. argent.*, 1943, 57: 97.

The authors report 3 cases of choleperitoneum with concomitant lesions of the pancreas. They emphasize the fact that this condition is much more frequent than is generally assumed. Both conditions, acute pancreatitis and so-called "filtering cholecystitis," may exist simultaneously. The prognosis and therapy depend on the presence of an acute pancreatic necrosis. Conservative treatment is contraindicated and should give way to surgical intervention, consisting of drainage of the biliary passages, pancreas, and/or the peritoneum, according to the conditions found during the operation. It must be admitted that under conservative treatment, such as splanchnic anesthesia, a re-establishment of the biliary flow and regression of the pancreatic process is possible, but such a contingency is very rare.

Generally speaking, the prognosis is grave and depends on the condition of the liver and the intensity of the lesion of the pancreas, viz., whether edema, necrosis, or hemorrhage is present.

All 3 cases reported by the authors resulted in recovery after the operation.

Apparently, changes in the gall-bladder wall allow the bile to filter through it and cause a biliary peritonitis in the presence of a biliary infection.

JOSEPH K. NARAT, M.D.

GASTROINTESTINAL TRACT

Pollard, H. M., and Lopes Pontes, J. P.: Comparative Study of the Gastroscopic, Roentgenological and Pathologicoanatomical Findings in Gastric Lesions (Estudo comparativo dos achados gastroscópicos, radiológicos e anatomo patológicos nas afecções gástricas). *Hospital*, Rio, 1943, 23: 327.

This study is based on observations of 82 cases, including 25 patients with chronic gastric ulcers, 4 with primary gastritis, 14 with duodenal ulcer, 32 with cancer of the stomach, 2 with lymphoblastoma, 1 with reticulocytoma, 3 with a gastric polyp, and 1 with a cancer of the pancreas and associated gastroscopic changes. From the analysis of the data concerning these cases, the authors draw the following conclusions:

1. Gastroscopy and roentgenology, as the only direct diagnostic procedures for the detection of gastric ulcer, should be employed concurrently. Although the x-rays reveal the lesion a little more frequently, gastroscopy appears to make it possible to discriminate between a benign and a malignant lesion in a higher proportion of cases. Both methods have their own limitations and so-called blind spots. Gastroscopy is the only reliable method available for the diagnosis of a primary or associate gastritis.

2. Gastroscopy is of considerable help in the recognition of certain types of localized gastritis which roentgenologically may simulate a neoplastic formation.

3. Although the diagnosis of a duodenal ulcer is based chiefly on roentgenological findings, gastroscopy rendered aid in the location of the lesion in 5 cases in which the pyloric canal appeared markedly distorted. By direct visualization of the whole antrum, the endoscopic examination may reveal a lesion distal to the pyloric valve.

4. As to the series of malignant cases, gastroscopy revealed their character in 81.2 per cent of the cases, while a positive diagnosis of malignancy was made with x-rays only in 53.1 per cent. In 2 cases the roentgenological study completely overlooked the lesion which was recognized at the gastroscopic examination. The authors believe that the gastroscopic procedure gives more accurate information as to the extent of the neoplastic invasion than the roentgenological studies. However, the authors emphasize the advantage of combining both of these methods.

5. It is difficult, if not impossible, to distinguish various types of neoplasms of the stomach by means of the gastric examination. Two cases of lymphoblastoma and 1 of reticulocytoma were gastroscopically diagnosed as carcinoma.

6. In the case of a carcinoma of the pancreas the gastroscopic image was not that of an extrinsic tumor. There was a marked dilatation of the veins and congestion of the mucosa, without any evidence of atrophy.

7. A comparison of gastroscopic and microscopic findings in various types of inflammatory lesions of the gastric mucosa revealed a high proportion of identical diagnoses in cases of hypertrophic gastritis, and a smaller number in atrophic (40 per cent) and superficial gastritis (33.3 per cent).

In some cases in which the gastroscopic diagnosis of a hypertrophic gastritis had been made, the histological study did not disclose a true hyperplasia of the mucous membrane but rather a marked lymphocytic infiltration and hyperplasia of the lymph follicles in the submucosa.

JOSEPH K. NARAT, M.D.

Tracey, M. L.: Gastric Diverticula. *Gastroenterology*, 1943, 1: 518.

Diverticula of the stomach are rare. At the Lahey Clinic this diagnosis, based on roentgenological findings, has been made in 35 cases. In 2 other cases the condition was suspected but not proved by roentgenography. It is difficult to attribute the formation of a diverticulum to any particular cause. The most

common site of this lesion is on the posterior wall near the cardiac orifice. At this area there is a thinning out of the circular and oblique muscle fibers as the longitudinal bundles continue down from the esophagus and divide into two muscular bundles. This is also a pressure point for all food entering the stomach.

These lesions have been classified by the author as follows:

1. Congenital or true. All muscle coats are present in this type.
2. Acquired or false
   a. Pulsion
   b. Traction

The symptoms were many and varied and in most cases not suggesting the diverticulum as the cause of the trouble. In 27 cases they were cardiac; in 3, pyloric; in 4 they were referred to the anterior wall, and in 1 case to the posterior wall.

The associated lesions were: duodenal ulcer in 7 cases, carcinoma of the stomach in 3 cases, cholelithiasis in 2 cases, and diverticulosis of the colon in 2 cases.

Seven diverticula were identified at operation. Two were excised. For diagnosis the stomach is aspirated to remove all residue, and a small amount of barium in mineral oil is administered. The first swallow is important. The rugal pattern is observed and the position is changed to prone or supine in order to outline the cardiac and fundic areas. This technique will usually reveal several flecks, filling defects, or distortions. A diverticulum will usually appear as a smooth pouch with little or no disturbance of the mucosal pattern.

Gastroscopic examination has confirmed the diagnosis in several cases; however, it affords little information in the typical lesion at the cardia, and there is the possibility of perforating a diverticulum in this area.

A benign ulcer is likely to be surrounded by prominent rugae which radiate in star fashion, while a malignant lesion shows loss of mucosal folds. A diaphragmatic hernia increases in size with respiration and increased intra-abdominal pressure. Retention and fluid level are important in diverticula. Usually the diverticulum can be emptied of liquid or food by postural means and refilled with barium to identify the smooth outlines and confirm its uncomplicated nature.

All cases with other conditions responded well to treatment. As surgery is hazardous it should be considered only if symptoms can be attributed to the diverticulum, if obstructive symptoms intervene, if uncontrollable ulceration or neoplastic tissue within the diverticulum is suspected, or if medical treatment has failed.

If the diverticulum is uncomplicated medical measures usually suffice. Antacids and postural drainage are advised. Improvement in the roentgenological appearance of the lesion under treatment is compatible with ulcer but not with an uncomplicated diverticulum. JOHN A. GIUS, M.D.

Held, I. W., and Busch, I.: Cancer of the Stomach, with Special Reference to Early Diagnosis. *Ann. Int. M.*, 1943, 18: 719.

The small percentage of five-year survivals following operative intervention in cases of carcinoma of the stomach has been very discouraging. The aim of all diagnostic methods has, therefore, been to establish an early diagnosis. Nevertheless, only between 30 and 40 per cent of cases of resectable cancer of the stomach are submitted to the surgeon. Patients with cancer who never reach the operating table are in one of two categories. The cancer is either of such a malignant nature that it spreads very rapidly to the neighboring glands and organs, or to distant structures; or the growth has invaded a silent area of the stomach, remaining asymptomatic. Such a patient presents himself for treatment when the lesion has already reached an inoperable stage.

It seems appropriate to divide cancer of the stomach into two groups. The first group comprises those cases in which the cancer starts on a perfectly healthy gastric mucous membrane. In the second group the cancer starts on a previously diseased mucous membrane.

Approximately 70 per cent of all the cases belong in the first group. In reality, the patient will often volunteer the information that he has had an iron-clad stomach and could digest everything. Although most of these patients are above the age of fifty, the cancer may occur in younger individuals, and even before the age of twenty. The younger the individual, the more malignant the growth.

When the cancer affects the silent area of the stomach (the greater curvature of the pars media or the lesser curvature) involving more of the anterior than of the posterior wall, gastric motility is usually not interfered with. Consequently the patient does not present himself until a good-sized palpable mass can be detected in the epigastrium. The subjective symptoms are extremely vague, consisting of epigastric distress, belching, fullness in the epigastrium, loss of appetite, coated tongue, and dryness of the mouth. There may be only moderate loss of weight, especially if the symptoms are of a few weeks' duration. Gastric acidity may be normal, although occasionally there is subacidity or even anacidity. Normal acidity should not influence the diagnosis. In younger individuals, particularly in the rare cases of cancer of the stomach occurring before the age of thirty, all the clinical evidence of cancer can exist despite a perfectly normal acidity.

When the cancerous lesion involves the posterior wall of the pars media, pain in the epigastrium radiating to the back is a prominent symptom. The pain is often excruciating, and is worse at night, necessitating the administration of narcotics. The greater the involvement of the posterior wall, the less accessible is the lesion to palpation.

If the cancer invades the entire anterior and posterior walls of the pars media, the characteristic cancer hourglass stomach is produced. The edges of the constricted portion are irregular, and the canal be-

tween the upper and lower part of the hourglass is centrally situated, in contradistinction to the canal of the hourglass due to ulcer, in which case the connecting canal is on a line with the lesser curvature of the stomach. Furthermore, in cancer hourglass stomach the upper sac fills only partially with barium and, therefore, is smaller than the lower sac which is more completely filled. This is due to the rigidity of the canal which permits the barium to rush through. On the other hand, in the ulcer hourglass, the connecting canal between the two sacs is usually spastic and inhibits the passage of the barium meal. The upper sac, therefore, contains the greatest part of the barium meal.

If the cancer develops at the next most common site, namely, at the prepyloric region, and if it is not the rare annular type which invades the lumen of the pylorus, motility disturbances are absent. Such patients have insufficient subjective symptoms to present themselves for early treatment. When seen they have a large, tender, freely movable, palpable tumor in the epigastric region and to the right of the median line. In these cases there is subacidity or anacidity.

Cancer of the pyloric region usually develops later in life than does cancer of the pars media, and it is often very insidious in onset. The symptoms are very vague, consisting primarily of loss of appetite, with a marked dislike for meats. A patient in his late forties or fifties with no previous digestive disturbances, who presents himself with such symptoms, even if the acidity is normal, should be subjected to a very careful roentgenologic and gastroscopic examination in order that the cancer should not be overlooked in its earliest stage. The rapid passage of food into the duodenum visualized roentgenologically is an important finding in early cases of pyloric cancer. The pylorus presents a rigid tube which, however, is not irregular, so that unless the roentgenologist knows the clinical history, he may be unable to make a diagnosis of cancer from the roentgenray examination alone. The rapid passage of food during the early part of digestion is due to the fact that the sphincter pylori has not been invaded by the lesion and is patent. Disturbed motility is an early phenomenon if the lumen of the pylorus is invaded by an annular carcinoma. Subacidity is the rule, and lactic acid is also present if there is marked gastric stasis. Epigastric pain, relieved by spontaneous or induced vomiting, is frequent in these cases.

Occasionally the cancer invades the posterior wall and lesser curvature of the stomach exclusively. Characteristic symptoms are: persistent pain in the lower dorsal and epigastric region, frequent vomiting of bile-stained gastric secretions, regurgitation of gastric secretions into the esophagus and mouth which causes burning in the epigastric region and behind the sternum, persistent dryness of the throat and tongue which is frequently fissured. The pain and regurgitation are aggravated when the patient lies on his back, so that he seeks a comfortable position for relief of these symptoms. In most of these instances the cancer is a slowly growing scirrhous type and the roentgenological evidence reveals a rigid pars media, the absence of peristalsis, and occasionally actual deformity of the pars media.

A rarer site of cancer of the stomach is the cardia. Deglutition disturbance is the earliest symptom, and cardiospasm is always present. It may be extremely difficult at times to detect the cancer roentgenologically. Films should be taken in every possible position, namely, standing, recumbent, supine, right and left oblique, and particularly in the Levy-Dorn position, i.e., with the patient in the supine position, buttocks elevated, the rays directed to the cardiac end. Esophagoscopy and gastroscopy are of diagnostic aid.

Another site for a slowly developing carcinoma is the entire posterior wall of the stomach without invasion of the anterior wall or curvatures, in which the roentgenogram is negative and no mass is palpable. Only gastroscopic examination with a biopsy can establish the diagnosis. Pain in the upper abdomen independent of meals is the most striking symptom, but the diagnosis may be overlooked for months or even years because of the negative findings. Therefore, early gastroscopic examination is urgent in these cases.

Of major importance in this discussion are the remaining 30 per cent of cases in which the cancerous lesion developed on a previously diseased mucous membrane, following gastritis, polyposis, or gastric ulcer. This type has a tendency to grow much slower, be more benign in character, and when diagnosed early offers the patient a great chance for prolongation of life and even permanent cure.

Individuals with ulcer symptoms but without ulcer signs should be looked upon with greater suspicion and more watchfulness for early cancer than those in whom ulcer is clinically and roentgenologically demonstrable.

The high degree of anemia and the size of the palpable mass should not deter one from operative intervention provided preoperative and postoperative treatment are carried out with the greatest care.

JOSEPH K. NARAT, M.D.

Timoney, F. X.: Perforated Peptic Ulcer. *Ann. Surg.*, 1943, 117: 710.

A total of 254 cases of perforated peptic ulcer was studied. The clinical diagnosis of perforated peptic ulcer was correct in more than 95 per cent of the cases. There were 246 operations performed, with 48 deaths, an operative mortality of 19.5 per cent. This was compared with a series of 49 recent cases in which sulfanilamide was implanted in the peritoneal cavity and in the wound, with 2 deaths, an operative mortality of 4 per cent. In a total of 246 operative cases there were 63 instances of wound infection, an incidence of 25.6 per cent. In the 49 cases treated with the intraperitoneal implantation of sulfanilamide there were 4 wound infections, an incidence of 8 per cent. The importance of the preoperative use of Wangensteen suction is emphasized.

The implantation of powdered sulfanilamide in the peritoneal cavity and in the wound is indicated in the surgical treatment of perforated peptic ulcer. It is an effective agent in reducing the mortality and decreasing the occurrence of postoperative infection of wounds. JOHN J. MALONEY, M.D.

Folley, J. H.: The Medical Management of Intestinal Obstruction, with Special Reference to the Use of the Miller-Abbott Tube. *N. England J. M.*, 1943, 228: 606.

Distention of the bowel is a factor which initiates the physiological and chemical changes that occur in intestinal obstruction. Intelligent use of intravenous fluids and transfusions is effective in combating these changes temporarily, and nonsurgical decompression by intestinal intubation has been helpful in reducing the mortality from 30 to 10 per cent.

The proper technique in the insertion of the Miller-Abbott tube is discussed in some detail. The first step is to anesthetize the nose, which is done with a long cotton swab soaked with 2 per cent pontocaine. This is passed through the nares until its tip rests on the posterior pharyngeal wall. After withdrawal of the swab, the tube which is well lubricated with a water-soluble gel is passed into the stomach. Suction is applied and the stomach emptied. The patient is placed on his right side and the stomach is distended with from 200 to 300 cc. of air to eliminate the reflex contraction of the antrum found in cases of intestinal obstruction. Enough slack is placed in the stomach to allow the tip to penetrate well into the duodenum. The patient then lies on his right side. Suction is maintained and clear fluids without milk are allowed until the tip passes into the duodenum. This is most readily identified by means of the injection of air into the balloon. If the balloon distends with little or no resistance it is in the stomach, while a strong, steady resistance means that the balloon is in the pylorus. The resistance in the duodenum comes and goes irregularly, independent of respiration. When the desired resistance is noted, more tubing is passed through the nose. After a fifteen minute wait, the desired amount of air is injected into the balloon and the inflation tip is clamped. The tube is then passed at the rate of about 15 cm. an hour. It is well to check the progress by daily x-ray films of the abdomen.

When rapid introduction of the tube is desired, the stylet technique of Abbott can be used; this technique is outlined. HAROLD C. OCHSNER, M.D.

Goodman, M., and Silverman, I.: Acute Appendicitis in Patients with the Common Contagious Diseases. *N. England J. M.*, 1943, 228: 533.

The authors have reviewed the records of 29,802 patients with contagious diseases who were admitted to the Willard Parker Hospital, New York, between January 1, 1935, and April 1, 1941. Fifty-three of this number had concomitant acute appendicitis, an incidence of 0.18 per cent.

One hundred and two cases of acute appendicitis and pseudoappendicitis, including the authors' cases and additional cases collected from the literature, were analyzed with respect to age, sex, leucocyte count, and time relation between onset of the appendicitis and the manifestations of a contagious disease.

Appendicitis complicating measles tends to occur during the invasive and catarrhal periods of the disease, from six days before to four days after the appearance of the rash. The severity of the measles apparently does not affect the incidence of appendicitis. The white blood cell and differential counts in acute appendicitis complicating measles were unaffected by the underlying or associated contagion. The treatment is the same as for acute appendicitis alone.

Abdominal pain is a rare complaint during the prodromal and eruptive stages of varicella. Its presence should suggest the possibility of appendicitis which may occur at any stage of the disease. The course of varicella was not modified by appendicitis and the presence of the contagious disease was no contraindication to appendectomy.

Appendicitis is an unusual complication of scarlet fever. The complaint of abdominal pain during the prodromal, eruptive, or convalescent stages of scarlet fever necessitates serious consideration of the possibility of coexistant appendicitis. No additional complications were produced by appendectomy in patients with scarlet fever.

The differential diagnosis of abdominal pain in mumps includes oophoritis, orchitis, pancreatitis, and appendicitis. Orchitis is often unilateral and usually occurs at the height of the parotid swelling. Oophoritis is difficult to differentiate, but is accompanied usually by higher fever than appendicitis and by chills. Pancreatitis is seen rarely before puberty and is associated usually with an elevated blood amylase value. No additional complications followed appendectomy in the presence of mumps.

Three patients with pertussis acquired acute appendicitis. Since the temperature usually is elevated only at the onset of pertussis, a secondary rise during the course of the disease may be of significance in the detection of appendicitis.

There was 1 case of appendicitis among 816 patients with rubella.

The authors urge the physician to have no hesitation to diagnose acute appendicitis in the face of obvious symptoms and signs merely because the patient has an obvious contagious disease, even though the latter in its usual course may be accompanied frequently by abdominal complaints.

EDWARD W. GIBBS, M.D.

Crymble, P. T.: Prolonged Fecal Fistula after Operation for Appendicitis. *Brit. M. J.*, 1943, 1: 532.

Three cases are reported of persistent and complete fecal fistulas of one, three, and four and a half years' duration, respectively, following appendectomy. From a review of these cases the author sug-

gests the following conclusions: Material to be used for drains following appendectomy should not be more rigid than a strip of corrugated rubber or a piece of gauze. Care must be exercised when handling inflamed or adherent intestine to avoid tearing or rupture. Patients may do quite well without the use of their colons when the fecal stream is diverted by a fistula. Local closure should be attempted only when the fistula involves the cecum or ascending colon and is some distance away from the valvula coli. If there are multiple openings or if the fistula is close to the valvula coli, a diversion operation should be followed by a colectomy on the right side at a later date. EDWARD W. GIBBS, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Verbrycke, J. R., Jr.: The Normal-Appearing Gall Bladder. Report of 32 Operated Cases, with a Long Follow-Up. *Am. J. Digest. Dis.*, 1943, 10: 190.

It is most embarrassing to operate for cholecystitis, after a careful study of the patient, only to be confronted by a bluish organ of soft consistency and perhaps without adhesions and, in addition, examination of the other abdominal viscera after removal of the appendix fails to reveal any pathology. Should the gall bladder be removed?

Cattell believes that a gall bladder should be removed when there is a history suggesting cholecystic disease, when the cholecystograms are suspicious looking or show pathology, and when other gastrointestinal disease is ruled out. The writer has collected a series of 32 such cases of comparatively normal-appearing gall bladders which he removed. In some, cholecystic adhesions were present; in others there was hepatitis; but in none was there evident gross pathology in the gall sack itself. It was thought to be of interest to present these cases and their outcome, especially in view of the rather poor end-results following operation on the noncalculous gall bladder.

It is quite generally believed that the more marked the pathology, the longer the symptoms, and that a definite history of gall-stone colic gives more satisfactory results following cholecystectomy.

Following cholecystectomy in 32 cases of relatively normal-appearing gall bladders, the end-results were traced for years. A surprising percentage of satisfactory results (87.5) was obtained without operative mortality. It appears perfectly possible to obtain as good results from cholecystectomy in properly chosen cases of relatively normal-appearing gall bladders as in the more diseased gall bladders. The patients must be carefully studied and operation decided upon only after mature judgment. Symptoms and tests should correlate. If the symptoms and tests warranted operation and no other satisfactory cause of discomfort can be found at operation, not only is it perfectly justifiable to remove the gall bladder even though it appears fairly normal, but excellent results may be anticipated.

JOHN W. NUZUM, M.D.

MISCELLANEOUS

Cottis, G. W.: The Fallacy of Peritoneal Drainage. *Am. J. Surg.*, 1943, 60: 204.

The evidence in the literature for closing the peritoneal cavity without drainage in peritonitis is reviewed, and the viewpoint of the author is presented. He uses drainage only for a localized abscess when the walls of the abscess are necrotic or when the integrity of the peritoneal lining is impaired. If the walls of the abscess are lined with intact peritoneum, it is treated in the same way as diffuse peritonitis, without drainage. Drains are most harmful in diffuse peritonitis. In untreated peritonitis the cause of death is almost always overwhelming toxemia. After this toxemia has developed operation of any kind is usually futile. In cases of death following operation with the insertion of deep drains, autopsy usually shows that the peritonitis at death was largely limited to the regions of the drains. A frequent cause of death is intestinal obstruction in the region of the drainage tract.

Of 374 cases of acute appendicitis, 216 showed acute inflammation of the appendix; none was drained and there were no deaths. Gross perforation and peritonitis, either diffuse or localized, occurred in 97 patients; drainage was done in 54 and of these 13 died, a mortality of 24 per cent; 43 were not drained and of these 4 died, a mortality of 9.5 per cent. In the undrained series only 1 death was due to peritonitis. Most of the undrained cases with the low mortality were those of diffuse peritonitis, while practically all of the drained cases with the much higher mortality had presented walled-off abscesses.

The advocates of delay base their position on the assumption that the mortality is less if the pus is allowed to become localized. Perhaps this is true if drains are used in cases of diffuse peritonitis. It is not true if these patients are treated by early operation, removal of the appendix, aspiration of the purulent fluid, and closure of the peritoneum without drainage. JOHN L. LINDQUIST, M.D.

Ariel, I., Jones, F., Pack, G. T., and Rhoads, C. P.: Metabolic Studies in Patients with Cancer of Gastrointestinal Tract. *Ann. Surg.*, 1943, 117: 740.

The authors indicated in a previous communication that 59 per cent of patients with gastric cancer develop hypoproteinemia. During the investigation of nitrogen excretion as the cause of hypoproteinemia in cases of gastric cancer, which failed to demonstrate an increased rate of tissue breakdown, evidence was found strongly suggesting that the patients could not synthesize serum albumin in normal amounts.

The present study was undertaken to ascertain if the usual end-products of protein digestion, i.e., the amino acids, were absorbed normally from the intestinal tract of patients with gastric cancer.

The glycine tolerance test described by Erf and Rhoads was used in the investigation.

Four groups of adult patients were used. In the first group, 6 patients with proved neoplastic diseases of the extremities were used as controls. In the second group, 6 patients with proved gastrointestinal cancer were used. In the third group, 3 patients with proved non-neoplastic gastric lesions were tested. In the fourth group, 3 patients who underwent total or subtotal gastrectomy for the removal of the cancer were given the test.

In summary, the 6 patients with gastrointestinal cancer showed a delayed absorption of glycine following the ingestion of 25 gm. of that amino acid. This abnormality probably was due to the presence of the cancer.

The high peaks of plasma amino-acid nitrogen curves which were obtained in the patients with gastric cancer suggest a delayed rate of utilization of that compound. Following removal of the stomach from a patient with gastrointestinal cancer, a rapid, high peak of the plasma amino-acid curve was obtained. This may indicate that the presence of the carcinoma contributes to the slow absorption, but not to the impaired utilization of glycine. The defective absorption and metabolism of the end-product of protein digestion in patients with gastric cancer may contribute to the hypoproteinemia state so frequently exhibited by these patients, since the production of plasma protein depends upon proper absorption and metabolism of the intermediary products resulting from the protein metabolism.

JOHN E. KIRKPATRICK, M.D.

Binkley, G. E., Abels, J. C., and Rhoads, C. P.: The Treatment of Postoperative Hypoproteinemia in Patients with Cancer of the Colon and Rectum. *Ann. Surg.*, 1943, 117: 748.

The physiological derangement of patients with cancer of the colon and rectum must be considered when surgery is contemplated. In these cases persistent hypoproteinemia may result in so-called liver shock, tissue edema, ascites, wound disruptions, altered motility of the gastrointestinal tract, and an increased susceptibility to infection.

The incidence of hypoproteinemia in patients with cancer of the rectum and colon was found to be 36 per cent. This incidence is increased to 86 per cent after the patients have been operated upon.

In the early preoperative period, hypoproteinemia is best treated by the intravenous administration of plasma protein. Later in the convalescence, sufficient amounts of dietary nitrogen may be ingested to counteract the postoperative deficiency.

It is believed that the correction of the postoperative hypoproteinemia is, in great part, responsible for the decreased mortality among patients with rectal and colon cancer.

The presence of infection in the patients studied considerably impaired the effectiveness of the measures outlined to combat the hypoproteinemia. In these instances, the refractory hypoproteinemia might have been due to the effects of the infection on the liver or to additional protein catabolism.

JOHN E. KIRKPATRICK, M.D.

GYNECOLOGY

UTERUS

Martin, C. L.: The Elimination of Irradiation Injuries in the Treatment of Cancer of the Cervix. *Am. J. Roentg.*, 1943, 49: 494.

Since the tolerance of the normal structures constitutes the limiting factor in any form of radiation therapy, the best technique is one which produces the largest number of good results with the lowest morbidity. The author during the past ten years has attempted to work out such a technique and he now lists the requirements as follows:

1. The use of multiple radium sources of moderate intensity for longer periods of time.
2. Frequent shifting of the positions of radium containers of the higher intensities.
3. Heavy filtration in all radium containers.
4. Distance applicators in the vagina used with large vaginal packs.
5. Removal of all presenting tumor tissues so that a smaller total radium dosage is effective.
6. Careful approximation of radium sources to malignant tissue.
7. Copious use of green soap in vaginal preparation for radium.
8. Frequent changing of vaginal packs.
9. No radon implants used and no radium needles placed near the ureters.
10. Intensive roentgen therapy used only in more advanced cases.
11. Elimination of lateral portals in rotentgen therapy.
12. Therapy given in one carefully planned series and not repeated.
13. Long interval allowed to elapse between intensive roentgen therapy and radium therapy.
14. No intravaginal or perineal roentgen therapy administered.

In January, 1942, a total of 149 consecutive unselected cases treated from 1936 to 1940 were surveyed to determine if any untoward effects resulted from the irradiation. The techniques employed were quite individual and therefore they were presented by tabulating the cases one by one. Briefly, the radium constituted the most effective part of the treatment and the roentgen therapy was given to make up for the radium dose deficiency. Most of the radium applications were made with capsules of various sizes containing from 6.25 to 50 mgm., used singly or in multiple combinations. The total dose amounted to from 3,600 to 4,100 mgm.-hrs. Multiple sources were preferred and they were never left in one place for longer than twenty-four hours. Cervical and vaginal applicators were never used on the same day. The roentgen therapy consisted in the administration of single doses of 600 roentgens each to four 15 cm. portals with 200 kv. In most instances, the radium applications and the roentgen treatments were given on alternate days, the series being completed within a period of a week. In very advanced cases, roentgen therapy was given first and the dose was fractionated to the extent of 200 roentgens daily to each of two portals until a total of from 1,200 to 2,400 roentgens per portal was reached. The radium was then applied at the conclusion of the roentgen series or, more frequently, three or four weeks later.

The final results compare favorably with those of other institutions, which give on an average a five-year survival rate of 26 per cent. However, the only complications which might be attributed to the effect of irradiation were 4 fistulas. Rectal or bladder ulcerations, intestinal obstruction, serious infections, or fractured hips have never occurred. A fair number of patients died with strictures of the ureters, but the incidence was no higher than that normally seen in untreated cases.

T. Leucutia, M.D.

Taussig, F. J.: Iliac Lymphadenectomy for Group II Cancer of the Cervix. *Am. J. Obst.*, 1943, 45: 733.

One hundred and seventy-five cases of Group II cervical cancer were subjected to removal of the iliac gland with radiation of the primary tumor. The operative mortality in the group was 1.7 per cent, with a mortality of 0.7 per cent in the last 140 cases. The five-year survival rate of 70 patients operated upon previous to October, 1937, was 38.6 per cent.

Upon comparing this with a five-year survival of 22.9 per cent in 118 patients with a similar condition and treated by radiation alone, it was found that there was a 68 per cent greater salvage when removal of the lymph gland was added to the radiation treatment. Cancer was found to be present in the lymph glands in 26.8 per cent of the 175 patients operated upon. Even in those with demonstrated metastases, a five-year salvage of 21 per cent was obtained.

This experience, extending over a period of twelve years, has firmly established iliac lymphadenectomy as a valuable adjunct in the treatment of Group II cancer of the cervix. Edward L. Cornell, M.D.

Mueller, J. H.: Therapeutic Effects in Cancer of the Cervix (Ueber die behandlungserfolge beim carcinoma colli uteri). *Schweiz. med. Wschr.*, 1942, 72: 909.

Of 137 patients with cancer of the cervix, 7 were not treated at all, 109 were submitted to fractional radium and roentgen therapy, 14 were operated on and given postoperative irradiation, and 7 were operated on but were given no postoperative treatment.

The author supplemented the classification of the League of Nations by creation of a group which he called "stage 0", in which neither the palpation nor clinical inspection allowed a diagnosis of cancer and the patient has no subjective symptoms; only a col-

poscopic examination, Schiller's iodine test, or histological examinations established the diagnosis.

An abdominal panhysterectomy was performed in all cases belonging to stage 0. Of 34 cases belonging to stage 1, 20 were irradiated; in 2 an operation was performed without postoperative x-ray therapy; and in 12 an operation followed by irradiation was performed. Of 64 patients in stage 2, 62 were irradiated and in 2 an operation followed by x-ray treatments was performed. Irradiation alone was the method of treatment in all cases of stage 3 and 4.

The majority of the patients were admitted in stage 2, in other words, in an inoperable condition, and yet in 48 per cent a five-year cure was obtained.

Still better results may be expected when methods for the early detection of cancer of the cervix are improved.

The author emphasizes the fact that cancer of the cervix is not confined to old age; a large percentage of cases consists of patients from twenty to fifty years old. Contrary to a prevailing opinion, the prognosis in relatively young individuals is not poorer than in older patients.

As to the choice of therapeutic measures, an operation is indicated in stage 0. Frequently the ovaries may be left untouched, in order to avoid castration symptoms. For the same reason no postoperative irradiation is recommended for this group.

JOSEPH K. NARAT, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

León, J., and León, C. T.: Dermoid Cysts of the Ovary. A Contribution on Their Roentgenological Diagnosis in the Pregnant and Nonpregnant Woman (Quistes dermoideos del ovario. Contribución a su diagnóstico radiológico en mujeres no grávidas y grávidas). *Sem. méd.*, B. Air., 1943, 50: 480.

The authors discuss the roentgenological diagnosis of dermoid cysts of the ovary. Two cases are reported in therapeutic and diagnostic detail, and reproductions of the roentgenographs and photographs of the tumors are included.

It is pointed out that dermoids of the ovary cannot always be diagnosed clinically and therefore the authors advocate the use of the roentgen rays. The tumors present a major complication in pregnancy and accurate diagnosis is essential. The plain flat plate which demonstrates osseous tissue with implated teeth confirms the diagnosis in dermoid cysts and thus immediately rules out the possibility of other abdominal and genital disease conditions.

Two cases are described in detail; one in a patient who harbored the cyst while pregnant and the other in a nonpregnant individual. The cases are complete, and the operative and reoentgenological findings are discussed with reference to the histological picture that the tumor presented.

It is pointed out that conservative operative procedures are advocated, but the authors make note of the fact that if insufficient ovarian tissue remains complete extirpation is indicated.

The article is appended with a complete bibliography.

ROBERT LICH, JR., M.D.

Siddall, R. S.: Sclerosis and Related Senile Changes of the Fallopian Tubes. *Am. J. Obst.*, 1943, 45: 785.

With advancing age, the fallopian tubes undergo certain changes, consisting, first of all and most typically, of a marked hypertrophy and sclerosis which involve the connective tissue of the folds. Later, there is also a replacement of ciliated epithelium by nonciliated and flatter cells. This sclerosis was noted in a high proportion (45 per cent) of cases with uterine leiomyofibromas. However, the occurrence had little or no relationship to the size of the tumors. Moreover, an investigation of a like number of cases, which corresponded in all particulars except for the absence of even tiny fibroids, showed the condition in approximately the same proportion, the incidence increasing in both series with advancing age. Sclerosis of the fallopian tubes showed no relationship to the history regarding previous pregnancies.

The incidence of the condition was increased with the development of irregularities and anomalies of menstruation, and this was most marked with the onset of the climacteric and afterward. The same tendency was noted also with the histological evidence of sex-hormone diminution. However, both with the latter and with the menstrual changes there were definite exceptions to the general rules. Examination of a small series of tubes associated with pregnancy showed that sclerosis is occasionally present, and therefore it (or its cause) is not an absolute barrier to pregnancy. Left unanswered, however, were such questions as its possible role as a relative factor in sterility and also as a cause of tubal pregnancy.

An interesting point incidental to the main purpose of this study was the discovery of such a high frequency of leiomyofibromas of the uterus in the material from Harper Hospital as to cast doubt on statistical studies which apparently indicate a relationship between fibroids and certain other conditions, particularly carcinoma of the uterine fundus.

EDWARD L. CORNELL, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Carapetyan, H.: A Combined Method for the Treatment of Delayed Menstruation and a Test for Early Pregnancy. *J. Am. M. Ass.*, 1943, 122: 81.

A nonspecific chemical agent, prostigmine, which is pharmacologically and physiologically related to physostigmine, has been used for the treatment of delayed menstruation, and its diagnostic value as a test in early pregnancy was observed.

The rationale for prostigmine therapy in menstrual delay is found in the premise that, in the physiology of normal menstruation, the events which lead to the ultimate appearance of menstrual bleeding are initiated or at least preceded by a state of hyperemia of the uterine tissues. This hyperemia is always present in the cyclic menstrual flow and is produced by estrogenic substances, which when acting on the uterus, release acetylcholine in this organ. The acetylcholine thus produced in turn causes vasodilatation. It has been demonstrated that this hyperemia is under the control of the parasympathetic nervous system and that nonspecific chemical agents can produce hyperemia in the uterine tissues similar in all respects to that resulting from the action of estrogenic substances.

If it is assumed that diminished acetylcholine in the uterine endometrium and consequent lack of adequate vascularity of this organ is the causative factor in a given instance of menstrual delay, it would seem logical either to increase the acetylcholine content by administering this drug or to potentiate the action of that amount of the drug which is already present in the tissues. Prostigmine accomplishes the latter, theoretically if not actually, through inhibition of cholinesterase, the tissue enzyme which destroys acetylcholine.

In a study of 57 cases prostigmine methylsulfate was used as a therapeutic agent in delayed menstruation and was found to be successful in inducing a normal menstrual flow in all women who were not pregnant. The results were uniform and no ill effects were noted. While this drug was being used as a therapeutic measure for delayed menstruation, its value as a diagnostic agent in early pregnancy was observed, and its accuracy as a diagnostic test for early pregnancy was compared favorably to the Friedman modification of the Aschheim-Zondek test. All women who were not pregnant, and whose Aschheim-Zondek test was negative before, menstruated normally following prostigmine administration. No ill effects were observed in early or late pregnancies. All Aschheim-Zondek positive women and all others not subjected to the Aschheim-Zondek test, but in whom the state of pregnancy was confirmed by subsequent clinical observation, successfully continued their pregnancies.

Prostigmine as a therapeutic measure for amenorrhea had no effect on those women whose past menstrual history was marked by extreme irregularities and who manifested evidences of endocrine deficiencies with obesity, male distribution of pubic hair, or concomitant organic disease. Three such cases were treated. In each the Aschheim-Zondek test was negative, yet none responded to treatment. Later a large number of such cases were treated with similar results. This would seem to indicate that prostigmine is effective in only those women whose previous menstrual histories have been more or less regular and who have had no severe endocrine disturbances or organic diseases. Its use as a therapeutic agent in delayed menstruation should be confined to this type.

CHARLES BARON, M.D.

Chesley, L. C., and Chesley, E. R.: An Analysis of Some Factors Associated with the Development of Pre-Eclampsia. *Am. J. Obst.*, 1943, 45: 748.

Measurements of thiocyanate-available water (roughly equivalent to extracellular water) were made in 1,388 women in the last ten weeks of pregnancy. Two or more determinations were made in 552 of these patients. The incidence of abnormally increased available water was 19.96 per cent.

The incidence of pre-eclampsia was 6 times as great in women with excessive available water as in those with normal water. This difference could have been augmented by more frequent measurements of water. When excessive available water and lowered serum proteins were found together, there seemed to be an increased predisposition to pre-eclampsia.

Women with a history of toxemia in a previous pregnancy had a greatly increased incidence of excessive available water, even though they may not have developed a recurrence of hypertension. The incidence of excessive available water rose with increase in body weight. Heavier women with excessive water showed an increasing incidence of toxemia which was not found when the water was normal. Total weight gain until the time of the test did not have any effect upon the incidence of excessive available water or of toxemia unless the weight gain exceeded 30 lb. The rapidity of weight gain bore no relation to the incidence either of excessive available water or of toxemia until the gain exceeded 4 lb. per week. Measurement of available water is a better indicator of developing toxemia than is weight-taking.

Spontaneous variability in the blood pressure did not affect the incidence of excessive available water. If the variation exceeded from 20 to 25 mm. of Hg in the systolic phase, the incidence of toxemia was somewhat increased in patients both with normal and with excessive available water. As the usual level of blood pressure increased, there was a rise in both the incidence of excessive available water and

the incidence of toxemia. This did not apply in cases of chronic hypertension, in which the incidence of excessive available water was about 17 per cent.

In women who developed pre-eclampsia, the average interval of time from the measurement of available water to the appearance of hypertension was four weeks if the water was abnormal and six weeks if the water was normal. In a few cases, water retention preceded hypertension by as much as ten weeks.

The rate of gain in available water averaged from 250 to 300 ml. per week toward the end of pregnancy if dietary salt was not restricted. This gain in water tended to be maintained regardless of weight change.

In the present series, 59 per cent of the "pre-toxic" patients were picked out by the test. This percentage could have been improved by more frequent measurements of the available water. The test was not specific, inasmuch as 80 per cent of the patients showing excessive available water did not develop pre-eclampsia.

Patients with blood pressures consistently below 110/70 showed a low incidence of excessive available water, and seldom developed toxemia. This fact indicated that the test was of little use in about one-fourth of all patients. EDWARD L. CORNELL, M.D.

Mon, R. B.: Coexistence of Cancer of the Cervix and Pregnancy (La coexistencia del cancer del cuello uterino y embarazo). *Rev. méd. Rosario*, 1943, 33: 209.

Figures varying from 1 in 437 pregnancies to 1 in 12,383 pregnancies have been given for the frequency of the coexistence of cancer and pregnancy. In Rosario the figure is 1 in 7,833 pregnancies. From 1 to 2 per cent of the cases of carcinoma of the cervix are complicated by pregnancy. It is probable that in human cases the cancer already exists when pregnancy occurs. A table is given showing the findings, treatment, and results in the 32 cases that have been published in Argentina. Two cases in Argentine women thirty-nine and thirty-four years of age with fetuses five and four and one half months of age are described in detail. Wertheim operations were performed and the patients died.

These cervical cancers accompanying pregnancy may originate from glandular or pavement epithelium; the former are radioresistant, the latter radiosensitive. About 90 per cent of the cases are of the pavement-cell variety and 10 per cent are glandular.

The symptoms of both the cancer and the pregnancy are about the same as when they do not coexist. As in the nonpregnant woman, the diagnosis of early cancer may be made by the Schiller test or Hinselmann's colposcopy. Biopsy should not be attempted because of the danger of severe hemorrhage.

The evidence with regard to the effect of pregnancy on the growth of cancer is discussed and the author concludes that pregnancy hastens the growth of the cancer. The hyperemia brought about by the pregnancy has a tendency to hasten the growth of the cancer and the increased development of the lymphatic tracts furthers dissemination. In pregnancy there is also an increase of cholesterinemia and lipemia which favors the development of cancer. The puerperium has a particularly aggravating effect on cancer. As to the effect of the cancer on the pregnancy, it has a tendency to bring about abortion or premature delivery. When the child survives, its health does not appear to be affected by the cancer.

The treatment to be given depends on the stage of development of the tumor and of the pregnancy when the patient comes for treatment. It is generally agreed that roentgen rays should not be used in these cases because of the danger of an injurious effect of the rays on the fetus. Radium can be used, however, without danger. In operable cancer during the first half of pregnancy, when the mother must be considered rather than the child, the ideal treatment is total abdominal hysterectomy. If the pregnancy is between the fifth and seventh months an effort should be made to save the life of the fetus by giving small doses of radium (from 25 to 30 mgm.) vaginally and to the surface of the tumor. When the fetus becomes viable caesarean section should be performed and followed by total hysterectomy and deep roentgen treatment. From the seventh to the ninth month it is better to operate without preliminary radium treatment.

In inoperable cases the problem is more difficult, particularly in the first half of pregnancy. Radium may make some apparently inoperable cases operable, but, on the other hand, it may cause abortion. If the pregnancy is near the fifth month and it seems possible to save the fetus, radium should be used and the greatest possible care given to the health of the mother by means of transfusion and other measures. In the second half of pregnancy the treatment is like that in operable cases. AUDREY G. MORGAN, M.D.

LABOR AND ITS COMPLICATIONS

Mayes, H. W.: Vaginal Antisepsis during Labor. Eleven Thousand Vaginal Deliveries without a Death from Puerperal Infection. *West. J. Surg.*, 1943, 51: 201.

Deaths from puerperal infection still exceed those from hemorrhage and toxemia. The number of maternal deaths in 1935 was the same as in 1915: 24 per 10,000 live births. In 1940, this figure had been decreased to 17 per 10,000 live births. During 1940, 3,626 mothers in the United States died from puerperal infection—40.8 per cent of all maternal deaths.

The author, since 1928, has utilized the routine vaginal instillation of an antiseptic solution during labor in an effort to reduce the incidence of puerperal infection. Prior to the use of vaginal antisepsis there were 25 deaths from infection in 10,368 cases delivered. Since the introduction of the method, there have been only 6 deaths from infection in 25,347 cases; 4 of the 6 followed cesarean section and 2 were deaths from pulmonary embolism. During the eight years beginning January 1, 1934, the gross morbidity in 13,763 deliveries has been 7.8 per cent. The mor-

bidity after exclusion of the cesarean sections was only 5.3 per cent. There have been no deaths from infection in the last 11,000 deliveries. In 6,247 of the cases delivered vaginally, operative procedures were carried out and in this group there were no septic deaths. Although 32 per cent of the patients delivered during the last eight years had vaginal examinations during labor, the morbidity rate was only 1 per cent higher than among those who had only rectal examinations.

The antiseptic used is a 4 per cent aqueous solution of mercurochrome. After the pubic hair is shaved and the area cleansed with green soap and water the genitalia and surrounding area are sprayed with mercurochrome. The labia are then separated and an asepto syringe, containing 3 drams of the solution, is inserted along the posterior vaginal wall to the vault of the vagina. The labia are closed about the syringe and the fluid is forced into the vagina under slight pressure. The instillations are repeated at twelve-hour intervals during labor and at the time of vaginal examinations. During the post-partum period the perineum is sprayed at least once daily and 2 drams of the solution are instilled into the vagina for five or six days.

J. Robert Willson, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Moir, C., and Russell, C. S.: An Investigation of the Effect of Ergot Alkaloids in Promoting Involution of the Post-Partum Uterus. *J. Obst. Gyn. Brit. Empire*, 1943, 50: 94.

The long-held belief that continued administration of ergot favorably influences the course of uterine involution receives no support from the investigations reported in this article. The practice of giving the drug throughout the puerperium appears to arise from an imperfect understanding of the nature of uterine involution on the one hand, and of the mode of action of ergot on the other. There is little doubt that vast quantities of this drug are used daily for purposes that may fairly be described as wasteful, useless, and possibly even harmful.

Attempts were made to estimate the degree of involution of the uterus by measuring the height of the fundus in treated (with ergot) and untreated groups of patients. Attempts were also made to estimate the amount of lochia present. The difficulties in making dependable observations are explained in detail. The author points out that normal involution is characterized by alternate periods of contraction and relaxation, not by more or less continuous contraction, such as might result from ergot. He therefore doubts the efficiency of ergot in promoting "involution." Daniel G. Morton, M.D.

Butler, H. M.: Further Bacteriological Studies of Severe Clostridium-Welchii Infections after Abortion. *J. Obst. Gyn. Brit. Empire*, 1943, 50:105.

In Melbourne one of the greatest problems in connection with abortive infections is that of the fulminating types due to the clostridium welchii. At the Women's Hospital it is not uncommon for there to be as many as 12 deaths in one year from such infections.

In 1939 a special study of these cases showed that this organism was often present in the vagina, in the uterine contents, in the urine, and even in the blood, without causing symptoms of a severe infection. It was, therefore, clear that the mere isolation of the clostridium welchii from the tissues or body fluids of the patient was of little diagnostic significance so far as severe infections were concerned. It was also shown that the strains of this organism causing the severe infections differed from most of the strains obtained from patients who did not develop symptoms of a severe infection due to it, both in regard to growth characteristics and the amount of capsular material produced in broth.

In cases of severe infection cervical smears showed heavily capsulated bacilli and considerable destruction of the leucocytes. This combination was not seen in the smears from patients who, although infected with the clostridium welchii, did not show the symptoms of a severe infection.

These findings suggested that the severe clostridium-welchii infections associated with abortion were caused by only certain variants of this organism. It is the purpose of this article to set forth the evidence obtained in support of this contention.

More than 600 strains of the clostridium welchii recently isolated from abortive cases were studied in regard to one or more of the following:

1. Growth characteristics
2. Capsulation in broth cultures
3. Production of x toxin
4. Phagocytosis by human leucocytes
5. Pathogenicity of washed cultures for guinea pigs

It was shown that the severe generalized infections were caused by two distinct and recognizable variants and that the nature of the patient's symptoms was correlated with the characteristics of the infecting strain.

The strains causing the severe infections characterized by jaundice produced smooth-surface colonies, nongranular growth in serum-neopeptone-water, heavy capsules in meat broth, and large amounts of x toxin in vitro; they were resistant to phagocytosis by human leucocytes and were pathogenic for guinea pigs when washed cultures were used. In the cervical smears from patients infected with such strains the bacilli were surrounded by fragile capsules and there was evidence of considerable damage to the leucocytes.

The strains causing the severe infections in which collapse was the outstanding symptom differed from those isolated from cases with jaundice in three ways. First, surface colonies were unstable and typically smooth colonies did not predominate; second, these strains produced only small amounts of x toxin; and third, the capsules observed in the cervical smears were not fragile but clearly defined.

Only a few strains having all the characteristics of either of these two variants were encountered, apart from the cases of severe infection, and when such strains were met with they were usually present only in the vagina.

Since all but one of the strains causing the severe generalized infections were heavily capsulated, resistant to phagocytosis, and produced a fatal infection in guinea pigs when washed cultures were used, it appears probable that the invasiveness of the infecting strain is of paramount importance in the development of a severe abortive infection.

Clostridium-welchii exotoxin per se is probably not of primary importance in causing a severe generalized infection.

While the author agrees with the suggestion that the development of a severe clostridium-welchii infection may depend on the presence of some devitalized tissue, he stresses that the majority of such infections occur in the absence of a large amount of dead tissue, and that, no matter what the local conditions in the uterus, a severe generalized infection with the symptoms recognized as typical of these cases does not occur when the strain multiplying in the uterine contents lacks the characteristics we now recognize as typical of the highly invasive variants.

Probably the most necessary factor for the development of the severe infections is sufficient interference to introduce the clostridium welchii into the uterus. Without mechanical interference of some kind these infections are rare.

The comparative rarity of these severe generalized infections is readily explained by the finding that the highly virulent variants are only a very small minority of the clostridium-welchii strains recovered in abortive cases. In this hospital during the last three years less than 5 per cent of these organisms cultivated from the vagina have been of the type responsible for the fulminating infections.

It is clear that a complete bacteriological study of the infecting strain should be a necessary preliminary to the assessment of any form of treatment, e.g., with the sulfonamides, for the severe clostridium-welchii infections associated with abortion. That this is seldom done is evident from reports of recent cases.

DANIEL G. MORTON, M.D.

MISCELLANEOUS

Johnson, C. G., and Talbot, J. D.: The Use of Sodium Sulfathiazole in the Treatment of Septic Abortions. *Am. J. Obst.*, 1943, 45: 846.

Sodium sulfathiazole was given only to those cases proved to be septic, and not alone on a history of chills and fever or of instrumentation. When this condition existed, the patient was given an initial dose of 3 gm. of sodium sulfathiazole by mouth and then 1 gm. every six hours for five or more days. The drug was stopped if red blood cells appeared in the urine, if severe leucopenia developed, or if other signs of severe toxic reaction resulted.

There were a total of 124 clean cases that had a positive cervical culture, this representing 78 per cent of the clean cases reported. In the septic cases there were 34 positive cervical cultures, which was 77 per cent of the total number reported. It thus appears that the true present condition and prognosis of the patient could not be ascertained by a knowledge of the cervical culture alone.

The average hospital stay of septic patients who received sodium sulfathiazole was ten days. In studying a similar number of septic patients who were admitted to the Tulane service during the year 1940, and who did not receive any specific drug therapy, the authors found that the average hospital stay was thirteen days. Among the patients who received specific therapy, the average duration for the reduction of temperature to normal was approximately three days.

The mortality during the past five years has shown a steady downward trend. The lowest figures occurred during the years 1940 and 1941. This reduction in mortality has been accomplished through the use of specific chemotherapy.

EDWARD L. CORNELL, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Trabucco, A.: Some Roentgenological Findings and Anatomicopathological Results of Experimental Renal Trauma. *J. Urol.*, Balt., 1943, 49: 601.

The kidneys of dogs were subjected to three types of trauma: (1) direct contusions, (2) firearm wounds, and (3) wounds caused by a knife or similar instrument. After traumatism was produced the kidney was studied by excretory urography. The examination was made immediately after or within an hour of the production of trauma and thereafter at varying intervals of twenty-four hours, forty-eight hours, a few days, and several months.

When urographic examination is made immediately after the infliction of trauma, there is excretion of the opaque substance because no significant circulatory change or serious degeneration of the tubules has taken place. Urograms taken on subsequent days show marked diminution of the shadow with maximum diminution from fifteen to thirty days after trauma. Thereafter the kidney may gradually recover normal or relatively normal function, especially when it has not been extensively injured and above all when it has not become infected; or there may be absolute lack of elimination of opaque substance because of replacement of the greater part of the renal parenchyma by scar tissue.

Integrity of the renal capsule is of great importance in maintaining the kidney in its proper position and in maintaining its normal shape. When rupture of the capsule takes place, adhesions are produced between the kidney and the neighboring organs. When trauma has not affected the capsule, the kidney will usually be found in its proper position and maintains the same form as its mate. When the capsule is ruptured through crushing or incision, a marked extravasation of the opaque medium may occur into the lumbar fossa on the injured side.

From the experiments it is concluded that when trauma is not severe, operative interference is not advisable. Serious damage may result from attempts to repair the kidney; when surgical intervention is required extirpation of the injured organ is preferable to repair. However, if operative intervention is not resorted to in cases of severe injury, death is likely to result as a consequence of the acute hemorrhage.

The most serious injuries are those caused by firearms, especially lead bullets. Restoration of the renal function is likely to follow injury after a clean-cut incision, provided the kidney is not repaired and that the animal survives the hemorrhage induced by trauma. Contusion of the kidney is the least dangerous to the life of the individual of any of the three types of trauma studied but it may produce serious late effects on the functional integrity of the parenchyma.

Traumatic injury to the kidney produces several types of lesions: "proximity" lesions, glomerular, tubular, vascular, and interstitial lesions. Adhesions are the end-result of the proximity lesions. Clots are produced immediately; they line the wound and gradually establish strong adhesions with the renal parenchyma, the neighboring organs, and even with the abdominal wall. When urine collects or when infection occurs, actual perirenal pseudocysts and abscesses may be formed. Glomerular lesions depend upon the time that has elapsed since the infliction of the trauma. In recent injuries, congestion and hemorrhage are prevalent. The glomeruli at some distance from the site of injury as well as those in the injured area show congestion and hemorrhage in the glomerular cavity. As time goes on a total glomerular sclerosis develops with hyalinization in the injured zone. Necrosis of all the tubules is observed in the injured area within twenty-four hours after the trauma. Farther from the traumatic area there is albuminoid degeneration of the tubular cells with varied modifications. After traumatism, the renal capsule suffers marked thickening and where rupture has occurred a new capsule promptly connects with the existing one and closes the breach.

HAROLD C. OCHSNER, M.D.

Suter, F.: Determination of the Duration of Renal Tuberculosis (Beitraege zur Altersbestimmung der Nierentuberkulose). *Schweiz. med. Wschr.*, 1942, 72: 885.

The author reviewed 260 histories of patients with tuberculosis of the kidneys, who were operated on, in order to answer the following questions:

1. How frequently can tuberculosis in other organs, preceding the renal tuberculosis, be found in the history?

2. How frequently do so-called bridge symptoms occur between tuberculosis in other organs and the onset of renal tuberculosis?

3. Were there any signs or symptoms suggesting the onset of renal tuberculosis in cases in which no specific process was present in other organs previously?

4. What is the clinical cause of urogenital tuberculosis in cases in which the kidneys are the first demonstrable secondary site of infection?

The determination of the duration of renal tuberculosis is very difficult because the infection of the kidneys nearly always begins without any symptoms and because even pathologicoanatomical findings are not very dependable in this respect. The fact that a dissemination of tuberculosis through other organs preceded renal tuberculosis does not imply that the kidneys were involved concurrently with other organs. In the majority of cases no symptoms are present for a long time after the kidneys have been affected. Patients with renal tuberculosis who ap-

parently develop symptoms for the first time while on military duty are entitled to army insurance only if they have served at least several months and if the operative findings indicate that the condition developed after the man had been drafted.

Of 260 cases of renal tuberculosis reviewed by the author, 73 had a dissemination of tuberculosis preceding the development of the specific process in the kidneys. In descending order the following organs were attacked: the bones and articulations, the lungs, and the male genital organs. The time elapsing after the first involvement up to the second ranged from two to forty years, and averaged from eleven to fifteen years. JOSEPH K. NARAT, M.D.

Austen, G., Jr.: Calcification of Renal Tumors. *Am. J. Roentg.*, 1943, 49: 580.

Calcification of renal tumor has received comparatively little attention in the literature, which is reviewed. Of 131 tumors of the kidney recorded in the files of the Peter Bent Brigham Hospital studied by the author, 3 in a group of 25, not verified by pathological examination, showed roentgenographic evidence of calcium shadows in the tumors. Of 106 tumors verified by microscopic examination, 98 were malignant and 8 were benign. In the latter group were 6 adenomas of the renal parenchyma, 1 papilloma of the renal pelvis, and 1 leiomyoma of the renal pelvis. Only 1 of these, the leiomyoma, showed abnormal calcification. Of the 98 malignant neoplasms, 85 were carcinomas of the renal parenchyma, 8 were tumors of the renal pelvis, and 5 were miscellaneous tumors, including 2 embryonal or Wilms' tumors, 1 fibrosarcoma, 1 leiomyoliposarcoma, and 1 lipofibrosarcoma. Calcium deposits in the tumor tissue were demonstrated by roentgenologic and microscopic examination in 16 of the 98 malignant cases, a percentage of 16.3. Of these 16 cases, 14 were carcinomas of the renal parenchyma, 1 was a papillary carcinoma of the renal pelvis, and 1 a leiomyoliposarcoma of the renal capsule.

In the group of cases with calcified tumors, the average duration of symptoms varied between five and eight months, the shortest interval between the onset of symptoms and operation being two weeks, the longest two years. In contrast, the average duration of symptoms for cases with noncalcified malignant tumors varied between ten and fourteen months.

The shadows of calcification in renal tumors, as seen in the roentgenograms, assumed various patterns and were not in themselves distinctive. In the majority of cases, however, the involved kidney was enlarged or irregular. The calcified material could be demonstrated to lie in the area of the suspected mass and could be localized even more after the injection of a radiopaque iodide solution. Some shadows showed a scattering of irregular, mottled deposits throughout the entire tumor, while others showed only several small spiculated deposits in either the central or peripheral portions. Sometimes the calcified material was arranged in radial or circular strands, occasionally in whorls. The correlation of calcareous deposits with pathological sections is given consideration.

Follow-up studies of 13 of the 16 cases with calcification in an attempt to evaluate the prognostic importance of this finding showed a survival rate of 15.3 per cent as compared to one of approximately 30 per cent which was found among the cases without calcification. Although it is realized that the small number of cases studied prevents the drawing of positive conclusions, it appears that the prognosis of the former group is less favorable than that of the latter. A. HARTUNG, M.D.

BLADDER, URETHRA, AND PENIS

Marbury, W. B., and Fry, W.: Spontaneous Rupture of the Urinary Bladder. *Ann. Surg.*, 1943, 117: 760.

The term, spontaneous rupture of the urinary bladder, is now the accepted designation for all nontraumatic ruptures of the bladder.

Spontaneous rupture is relatively rare, comprising about 4 per cent of the reported cases of bladder rupture.

A case is reported of a second spontaneous rupture of the posterior fundus of the urinary bladder. This case seems to be the only one of its kind to be reported. The patient was an alcoholic, with a history of having been treated for syphilis. The cause was obscure. At operation, the rent in the bladder wall was sutured and adequate drainage of the bladder was provided. The patient recovered.

The most frequent causative factors in bladder rupture are: (1) hyperdistention from obstruction; (2) degenerative changes in the bladder wall from chronic distention; (3) pathological changes in the musculature due to diseases of the bladder or to the extension of neoplastic or inflammatory diseases in adjacent structures.

The symptoms and physical signs vary according to whether the rupture is intraperitoneal or extraperitoneal.

In the treatment of both types of rupture, early operation and the establishment of adequate urinary drainage are imperative.

The prognosis in intraperitoneal rupture becomes grave if operation is delayed longer than twenty-four hours. JOHN A. LOEF, M.D.

Davalos, H. A., Jr.: The Experimental Production of Stones in the Bladder. *J. Urol.*, Balt., 1943, 49: 639.

Great importance has been attributed to the following factors in the genesis of urolithiasis: infection, hyperparathyroidism, vitamin A deficiency, stasis, and metabolic factors, such as phosphaturia, oxaluria, and cystinuria.

It has long been known that microbes instilled into the bladders of experimental animals are not of themselves able to produce cystitis (the main factor in the formation of bladder calculi). There must, in addi-

tion, be favorable conditions of stasis, circulatory changes, or epithelial changes, traumatic or toxic. It is with this last condition, epithelial changes, that the experimental work reported was concerned. The changes in the epithelium of the bladder were produced by the use of an alcoholic solution of salicylic acid. The microbic culture used to infect the bladders of the animals (rabbits) was that of the proteus vulgaris, taken from a urine culture of a patient suffering from urinary lithiasis.

The technique employed in the animal experiments was as follows:

From 2 to 5 cc. of a 1:1,000 alcoholic solution of salicylic acid were instilled daily into the bladder of rabbits. After four days of such instillations, there was present a chemical cystitis due to the action of the acid. From 2 to 4 cc. of a twenty-four-hour culture of proteus bacilli was then instilled intravesically, the instillation being repeated every five days, with the purpose of maintaining a chronic infection in the bladder. The experimental animals were divided into 3 groups. In the first group were rabbits who received instillations of both salicylic acid and the proteus culture. One control group received only the salicylic acid, and the other only the proteus culture.

About 50 experiments were done. Ten animals developed bladder stones—all of them were in the first group.

From these experiments it can be concluded that the instillation of a chemical agent that produces ulceration of the bladder mucosa is a *sine qua non* for the production of an infectious lithiasis. The instillation of the chemical agent alone, or of the microbic culture alone is not sufficient to produce the precipitation of crystals in the bladder.

Individuals with a tendency toward lithiasis, therefore, should avoid infectious conditions of the urinary tract, especially those due to the bacillus proteus vulgaris, bacillus coli, and staphylococcus. It is important also to know the pH of the urine, especially in the presence of infection, and to try to maintain it on the acid side by means of diet and chemotherapy. SAMUEL KAHN, M.D.

Thompson, W.: Anuria from Tubular and Ureteral Obstruction Following Sulfapyridine Therapy. *Lancet*, Lond., 1943, 244: 647.

The author reports the case of a twenty-year-old soldier who after taking 10 gm. of sulfapyridine developed a progressive oliguria which resulted in an anuria. The blood pressure rose to 160/100 and the blood urea was 75 mgm. per 100 cc. Upon cystoscopy the bladder and ureters were found to be filled with sulfapyridine crystals. A ureteral catheter was introduced into the left renal pelvis with difficulty and upon its entering the pelvis dirty brown urine spurted from the catheter in a continuous stream.

A saline-glucose solution was administered intravenously and sodium bicarbonate was given by mouth. With this therapy the urine was found to be normal in fourteen days and the blood pressure had returned to a normal level. It was noted that the urinary volume during the stage of improvement did not vary, but the concentration increased gradually; so that it was assumed that the damage was to the tubular elements of the kidney.

The author notes that the kidney could have been spared the excretion of much salt had a 5 per cent glucose solution been given intravenously. Also, it is pointed out that sodium bicarbonate is essential since an alkaline urine not only furthers the solubility of sulfapyridine acetylate, but prevents the precipitation of acid hematin in the tubules. If the latter condition occurs it causes an additional block to the already injured renal tubules.

The author calls attention to the fact that it is necessary to observe cases receiving sulfapyridine therapy closely since anuria occurs soon after the initiation of treatment and recovery is dependent upon heroic and specific therapy.

ROBERT LICH, JR., M.D.

GENITAL ORGANS

Peirson, E. L., and Nickerson, D. A.: Biopsy of the Prostate with the Silverman Needle. *N. England J. M.*, 1943, 228: 675.

The authors report their experience with 36 cases in which the Silverman needle was used to obtain prostatic biopsies. The work was undertaken because of the high incidence of undiagnosed prostatic malignancy that was demonstrated by Rich of the Johns Hopkins Hospital in Baltimore, who found the incidence in 292 consecutive autopsies of men over fifty years to be 14 per cent, and 65 per cent of this was not diagnosed during life.

The authors used the Silverman needle since this method of prostatic biopsy is suitable as an office procedure and removes sufficient tissue for examination. In their opinion the punch biopsy is second to that of perineal exposure, while transurethral biopsy is thought to be not entirely satisfactory

Fig. 1. Low-power view of specimens. These were obtained from a patient with benign hypertrophy of the prostate.

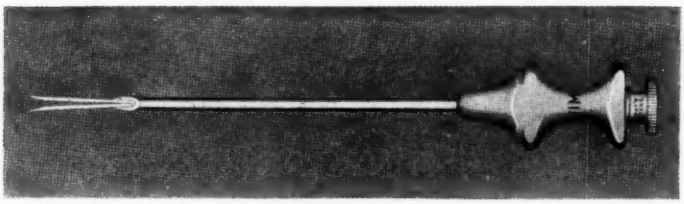

Fig. 2. The Silverman needle.

since often the carcinoma is not near enough to the urethra to allow removal of the tissue with the resectoscope. The Silverman needle was described in 1938, and in the opinion of the authors had never been used to obtain prostatic tissue. The needle is pictured in the accompanying illustration along with a picture of a typical section of tissue.

The technique for obtaining prostatic biopsies is simple. The patient after being placed in the extreme lithotomy position has the perineum infiltrated with novocain. With a finger in the rectum to guide the cannula with the contained needle to the suspicious area of the prostate, the pronged needle is then introduced into the tissue in question and finally the cannula is slid forward so that the tissue within the prongs of the needle is cut off. A piece of tissue is obtained that measures 1 by 10 mm. The tissue is immediately fixed on filter paper. It is interesting to note that the authors inadvertently introduced the needle into the bladder and this was followed only by some hematuria of short duration.

It is pointed out that only positive reports are of value and that several sections of tissue may be taken from the prostate in order to make certain that all suspicious areas are investigated. Also, the authors call attention to the possibilities of investigating the prostatic reaction to endocrine therapy by the use of this needle. This method of biopsy was found satisfactory in 86 per cent of 36 cases, and its simplicity recommends it for establishing or confirming the diagnosis of prostatic neoplasm.

ROBERT LICH, JR., M.D.

Melicow, M. M., Pelton, T. H., and Fish, G. W.: Sarcoma of the Prostate Gland. Review of the Literature; Table of Classification; Report of 4 Cases. *J. Urol.*, Balt., 1943, 49: 675.

Malignancies of the prostate gland, of mesodermal origin, are rare and are usually reported as round and spindle-cell sarcomas, fibrosarcomas, angiosarcomas, myxosarcomas, leiomyosarcomas, rhabdomyosarcomas, and lymphosarcomas. Interestingly enough, many of these cases are perhaps metaplastic or anaplastic carcinomas. However, because of their clinical features and the pathological findings, most of the accepted cases indicate that their origin is from prostatic elements other than glandular.

These conditions are very important, not only from a diagnostic point of view, but also from a therapeutic angle. Unfortunately, when they are discovered, cure is often impossible. The earliest symptoms of sarcoma of the prostate are usually frequency and nocturia. The onset is insidious, often without pain. As a rule, there is obstruction from compression and distortion of the posterior urethra and there may be urethral discharge. At times, because of obstruction and bleeding, retention is caused, or the lesion may not be discovered until a tumor mass is noted and then the symptoms will depend upon the obstructive capacity of this mass. Occasionally, dysuria and difficulty in defecation may be the first signs. As the disease is common in young people any unaccountable development of symptoms of obstruction of the vesical neck should at least make one suspicous of an early sarcoma of the prostate. If there is added to this, rapid loss of weight and increasing distress, every effort should be made to make an early diagnosis. In the majority of cases the diagnosis is made only at operation or autopsy. The prognosis is very poor.

The treatment is divided into surgical and radiological. The first type is indicated only for the relief of obstructive symptoms of either the bowel or bladder, and for the complications of the disease. Once the disease has spread beyond the capsule, prostatectomy is out of the question. Treatment by radiation appears to give the best results. The lymphosarcomas are supposed to be highly sensitive to irradiation, while the spindle-cell fibrosarcomas are peculiarly resistant to it.

The authors add 4 cases of sarcoma of the prostate to the approximately 200 cases which have been reported to date. Their 4 patients all died. The first had a spindle-cell fibrosarcoma, and died within eight months of the onset of symptoms; the second had a pleomorphic fibrosarcoma, and died two months after the onset of symptoms; the third had a rhabdomyosarcoma, and died one year after the onset of symptoms; and the last had a reticulum-cell sarcoma, and died six months after the onset of symptoms.

All of these patients had both surgical intervention and radiation therapy in some form.

While ordinarily this is a disease of youth, leiomyosarcoma or lymphosarcoma may occur in the fifth to the eighth decades. The disease develops insidiously and painlessly, but once started the lesion grows rapidly, breaks down all barriers, and causes obstruction. Operative procedures, except for the removal of obstruction, seem to accelerate the process. Radiotherapy often gives relief for

varying periods of time and there are a few cases on record in which it has been considered curative.

Young reports 2 cases which were symptom-free after four years. In 1926, Young again reported a single case, apparently cured with radiotherapy, while Bumpus has reported 3 cases treated by radiation and deep x-ray, in which life was prolonged for seven and one-half, three, and two years, respectively.

ELMER HESS, M.D.

Rea, C. E.: The Use of a Testicular Prosthesis Made of Lucite; with a Note Concerning the Size of the Testis at Different Ages. *J. Urol.*, Balt., 1943, 49: 727.

This is a report on the use of a cheap plastic as a testicular prosthesis and on the results in cases in which this substance has been used. Some impressions concerning the shape and size of the material used for patients of various ages are given.

The cost of two testes made from lucite is approximately $2.50; lucite is perhaps the cheapest of all materials used for this purpose.

It is not necessary to shape an epididymis on the testes as the best cosmetic result is obtained when the implants are perfectly smooth. Washing the implants with soap and water and leaving them in alcohol or tincture of merthiolate for one-half hour before they are used is sufficient sterilization.

The average adult testis measures 4 by 2½ by 2 cm., but the author believes that artificial testes of this size appear to be too large. Therefore it is preferable to have the artificial gonads smaller than this. It is not advisable to put artificial testes in children under puberty because of the disporportion of the gonads as the child gets older. After puberty the approximately correct size of the implants should be 3½ by 2 by 2 cm.

This technique is advised for men revealing total absence of the gonad in the scrotum and in whom other surgery is inadvisable. It is also used for the cosmetic and psychic results in orchiectomy for malignant tumor of the testes and after castration for carcinoma of the prostate.

ELMER HESS, M.D.

MISCELLANEOUS

Dees, J. E., and Fox, H.: The Properties of Human Fibrinogen Coagulum. Preliminary Report. *J. Urol.*, Balt., 1943, 49: 503.

This article deals with the preliminary observations of the authors concerning the action of clotting globulin on human fibrinogen solution which is to be used specifically in coagulum pyelolithotomy, a new operative procedure for the removal of small renal calculi. The removal of renal calculi by this method has been reported elsewhere. Five cases in which it was used demonstrated that this material causes no irritation of the pelvic mucosa and no obstruction of the renal tubules. Furthermore, in 2 instances of nephrostomy it was noted that the renal function returned to normal within from forty-eight to seventy-two hours after operation. The essential mechanism of this new procedure is that the clot completely fills the renal pelvis and calyces and incorporates all the calculi, so that when it is removed the renal calculi are extracted along with it through the pyelotomy incision.

The authors discuss the qualifications that would be ideal for such a coagulum and discuss various methods of clot formation. It was concluded that the clot must have a tensile strength between 40 and 60 gm ; a 2 per cent clotting globulin solution plus fibrinogen solution produced such a clot five minutes after it was mixed. The effect of time and temperature was studied in relation to clots so produced and it was noted that 60 per cent of the final residual tensile strength was obtained in the first five minutes. It was also noted that increased tensile strength was possible with prewarming of the fibrinogen solution. Blood and urine seemed only to reduce the tensile strength of the coagulum in proportion to dilution. Sulfathiazole was found to exert no bactericidal effect on the mixture since room temperature causes denaturation of the fibrinogen so that it was necessary to sterilize the solution with a Seitz filter.

The fibrinogen coagulum was tested for disintegration with extracts of squash and pineapple and 30 per urea and no effect was noted. However, human urine, sterile or infected, but unboiled, caused disintegration of the clot in eighteen hours, except in the case of dilute urine when the time element was increased. A similar effect was noted in reference to the blood clot.

In order to avoid the possibility that a stone coated with mucus or pus be not readily incorporated in the clot, a study of detergents was made with reference to the effect on the tensile strength of the coagulum. It was noted that duponal 1 per cent solution to a volume of 2 per cent can be incorporated without materially altering the tensile strength of the coagulum. The same condition was noted with sodium dodecyl sulfate. The exact role and necessity of incorporating detergents are at present under investigation by the authors.

ROBERT LICH, JR., M.D.

Mallory, M., Mathers, F., Orr, L. M., II, and Kundert, P. R.: Circulatory Disturbances in Prostatic Hypertrophy. *Ann. Int. M.*, 1943, 18: 835.

The authors discuss the cardiac status of the patient suffering with prostatism and the effect of prostatic surgery on the cardiovascular picture. They point out that individuals suffering from urinary obstruction due to prostatism will improve if the obstruction is removed. This point is effectively demonstrated by the fact that the cardiac with urinary obstruction is vastly improved following suprapubic cystotomy.

The literature is drawn on freely to add evidence to the authors' contentions and it is considered that the preoperative and postoperative management is a factor of great importance along with the experi-

ence of the operator. Statistics are quoted to substantiate these contentions. Among the important preoperative measures, rest and relief from urinary frequency and difficulty, along with avitaminosis, are mentioned, and the existence of anemia is an important factor.

Twenty-nine cases are discussed briefly as to the basis of relief following protatic surgery, as well as to their morbidity and mortality. It is noted particularly that only 2 patients of this group showed preoperative signs of circulatory failure and their condition became worse following surgery. One case is cited as an example of the group which successfully underwent resection under spinal anesthesia with considerable cardiovascular relief; three years before operation this patient had been considered a terminal cardiac.

The possibility of postoperative shock is given great stress in the article and it is considered advisable that each of these patients be given blood or plasma postoperatively to control their blood volume adequately and thus avoid shock. With careful preoperative and postoperative care, the authors believe that the mortality rate in this type of cardiourological patient can be anticipated to compare favorably with that of the most favorable surgical risks.

ROBERT LICH, JR., M.D.

Arthur, R. D., and Dermon, H.: Sulfathiazole as a Venereal Disease Prophylaxis. *Am. J. Syph.*, 1943, 27: 261.

In reporting a series of 1,000 exposures to venereal disease, Kline and Ryan described 1 case of gonorrhea that developed after sulfathiazole prophylaxis. Two grams of the drug were administered the morning following exposure and again later in the day. Gonorrhea occurred in 2 patients who received one-half of the total dose. There were 79 cases of gonorrhea among those not taking sulfathiazole. No reference was made to the appearance of chancroid, or what percentage of the patients used routine prophylaxis after contact.

PLAN OF STUDY

In a unit of Negro troops, a series of 583 known exposures to contacts almost certain to be infected with venereal disease was followed up.

Sulfathiazole prophylaxis was instituted the morning after exposure. It consisted of 3 gm. immediately after breakfast, 2 gm. after dinner, and 1 gm. after supper. The drug was administered to 152 men and about 40 of these repeated this type of prophylaxis one or more times after they had experienced subsequent contacts.

Even if sulfathiazole was able to prevent or abort the clinical manifestations of gonococcal infection it might not be able to prevent the development of an asymptomatic carrier state. After a reasonable period of time, cultures of the prostatic secretion were made, because there would be obtained in effect a urethral washing as well as evidence from the deeper focus.

CONTROL GROUP

Nine cases of primary syphilis were found in the control group of 259 men. The 384 exposures in this group consisted of those in the unit who had failed to receive sulfathiazole tablets after contact. The data were tabulated from the hospital records of those infected and from the prophylaxis receipts turned in from the various stations. There were 18 cases of chancroid and 15 of gonorrhea. The majority of infections appeared in those who had received no protection.

On close and repeated questioning it appeared that in this unit venereal-disease exposure took place repeatedly while on a single pass. Therefore the first of a series of contacts may have been made hours before the routine prophylaxis was taken, although the recipient often stated the exposure occurred twenty to thirty minutes previously. Others in this group gave one reason or another for omitting entirely the prophylaxis. As for condoms, physical contact before and after using and contamination during removal destroy their efficiency. Thus the routine methods of protection against venereal disease have their deficiencies.

EXPERIMENTAL GROUP

There was no clinical urethritis in the sulfathiazole treated group. There were, however, 8 cases in which there was found a positive prostatic culture for gonococci. According to the physical records of these 8 men, 2 had had gonorrhea over a year ago, and 1 had it eighteen months ago. The other 5 denied ever having had gonorrhea and this was borne out by their army records as far back as sixteen months, their approximate length of service.

Prostatic cultures for gonococci were made on all of the group taking sulfathiazole. These and inspections for venereal disease on all of this experimental group (152 men) were performed not earlier than five days after exposure, with the majority being performed in about two weeks. Routine monthly venereal-disease inspections were accomplished on the whole unit as well.

It is well known that gonococci may lie dormant for four years or possibly longer. There is no way of determining whether the 5 asymptomatic carriers who denied ever having had gonorrhea acquired the infection from their recent exposures or had an infection existing prior to the past sixteen months.

JOHN A. LOEF, M.D.

Strauss, H., and Grunstein, I.: Sulfathiazole Therapy of 500 Prostitutes with Chronic Gonorrhea; The Control of Venereal Disease in Wartime. *J. Am. M. Ass.*, 1943, 121: 1187.

A study of 615 hospitalized gonorrheal patients showed that 60 gr. of sulfathiazole daily for one week gave a 95 per cent apparent cure. The administration of sulfathiazole or sulfapyridine to the cases not cured increased this rate to 98.9 per cent. However, careful scrutiny is necessary in order to determine the permanence of the immediate results. In each

case it must be ascertained whether treatment has been sufficient and whether the period of observation has been adequate.

Most important of all is the determination whether the criteria of cure employed are sufficient to insure protection of the public against further infection. Detection of the asymptomatic carrier is obviously difficult and the health departments can defeat their own purpose by releasing patients before cure in the custody of a private physician because of an interpretation based on the present law.

The authors consider that a prostitute, although treated, remains potentially infectious for approximately three months. The cure of an infected prostitute requires adequate compulsory hospitalization. The authors believe that repeated offenders should be interned for the duration and compelled to aid in the war effort; if the law now does not adequately remove this public health hazard, remedial statutes are needed. WALTER H. NADLER, M.D.

Herrell, W. E., Cook, E. N., and Thompson, L.: The Use of Penicillin in Sulfonamide-Resistant Gonorrheal Infections. *J. Am. M. Ass.*, 1943, 122: 289.

An experimental study has been made of the antibacterial activity of penicillin against several strains of neisseria gonorrhoeae isolated from patients in whom the infection was completely resistant to what might be considered adequate treatment with sulfonamide preparations. These strains of organisms are inhibited completely in fairly high dilutions of an active form of penicillin. Bacterial cultures reveal that the number of organisms is decreased greatly at the end of one or two hours of contact with penicillin. Between the second and third, or third and fourth hours in contact with penicillin no viable organisms were found. This experimental evidence immediately suggests that penicillin should prove effective in the treatment of clinical infections due to these sulfonamide-resistant bacteria.

The complete absence of toxicity following the intravenous administration of pyrogen-free penicillin, the lack of any discomfort to the patient, and the rather rapid disappearance of clinical symptoms have been observed in 3 (later increased to 5) cases of sulfonamide-resistant gonorrheal infections. For the treatment of these infections the largest amount of penicillin administered in twenty-four hours was 32,000 Oxford units. Half of the twenty-four-hour dose was dissolved in 1 liter of isotonic solution of sodium chloride. If for any reason the administration of isotonic solution of sodium chloride is undesirable, penicillin may be administered in a 5 per cent solution of dextrose in triple distilled water without any loss of activity. Initially, between 100 and 200 cc. of the material are administererd intravenously at a fairly rapid rate. Following this the rate of injection is regulated to between 30 and 40 drops per minute. The second liter containing penicillin may be attached to the continuous intravenous system from eight to ten hours later.

Repeated venipunctures may be avoided by allowing the solution of dextrose to drip in slowly during the interval in which penicillin is not being administered. A simple arm splint is applied to keep the arm in position. This is tolerated well by the patient and renders the continuous intravenous administration possible and not uncomfortable. The solution containing penicillin is made up immediately before use. There is no evidence of loss of potency of the material which is kept in the closed system and is administered in the manner described. It should not be overlooked that administration of the solution of penicillin is to be continuous rather than intermittent.

Because of the limited amounts of penicillin available, penicillin therapy should be reserved and studied further in those cases in which the infection is resistant to the accepted forms of treatment now being used. In all of the cases reported, in addition to the clinical response noted, negative bacterial cultures were obtained sometime between seventeen and forty-eight hours after the institution of penicillin therapy.

Stammers, F. A. R.: Lymphogranuloma Inguinale (Tropical Bubo). *Brit. M. J.*, 1943, 1: 660.

One of the diseases very common among the natives of West Africa is tropical bubo, or lymphogranuloma inguinale. It also affects Europeans, although in smaller numbers, and therefore will from time to time appear in hospitals in England.

It is a virus disease of venereal origin, occurring in the tropics. It affects both sexes—the men by a primary lesion on some part of the genitalia, followed by enlargement of the glands in the groin; the women by vulvovaginitis, esthiomene, and proctitis, the last named leading to stricture of the rectum, of which the author saw very few cases.

The primary lesion—in the form of one or more very small vesicles, pustules, or ulcers rather like herpes, usually found on the glans and inner surface of the prepuce, but also sometimes on the body of the penis—develops within a few days of intercourse, and unless complicated by superimposed infection is of fleeting duration. It causes little or no discomfort, and the patient scarcely ever presents himself at this stage. From three to eight weeks later a gland in one or both groins enlarges, usually at the inner end.

It is almost invariably for the enlargement of the glands that the patient seeks advice, and this rarely earlier than three weeks, and usually after about six weeks after the infection was acquired. At first the condition may be entirely painless, in which case the patient either reports in order to find out the significance of the swelling, or not at all. Later on, however, pain develops. The condition then progresses through such constant phases that definite stages may be recognized:

Stage I. A solitary, elastic, freely movable gland, adherent to neither skin nor deeper structures. Little or no constitutional disturbance. Rarely tender, but physical activity may cause pain.

Stage II. The solitary gland becomes adherent to the skin and deeper structures, and there is a tendency for the surrounding glands to enlarge and become fused with the original one. In Europeans it is common for the glands along the external iliac artery to be involved, sometimes forming a large mass above Poupart's ligament, and later spreading up to the common iliac and even the aortic glands. In some instances there is a brawny mass in the groin, with *peau d'orange* appearance of the skin. The mass is tender and painful but nonfluctuant, and the constitution is considerably upset: temperature up to 103 F., pulse around 100, malaise, anemia, bronchitis, jaundice. This constitutional disturbance is always more pronounced in the European than in the native. A section of the original glands at this stage has a very characteristic appearance, looking like a gland packed with tiny abscesses.

Stage III. The original mass, be it large or small, softens in one or more places, and fluctuates, and the general condition of the patient improves. The author has never seen the glands along the external iliac artery break down. On section the softened area consists of a cavity broken up by interlacing trabeculations of fibrous tissue and containing sterile, glairy, sticky fluid that adheres to the knife, the whole being the result of coalescence of the earlier tiny points of necrosis.

Stage IV. Spontaneous fistulation has occurred and secondary infection quickly follows.

There is no doubt that among natives some of the cases never pass beyond Stage I and subside spontaneously without the men ever reporting themselves as being sick. It is an observed fact, too, that in some patients who report in Stage I and are put to rest in their billet for a few days the condition subsides spontaneously. However, the difficult case is that in Stage II, which in spite of rest shows no improvement but rather becomes worse. It is to such cases that this communication especially draws attention, since the European reacts in this manner, hardly ever clearing up spontaneously, even in the rare event of not progressing beyond Stage I; the vast majority pass well into Stage II with marked constitutional effects. The various lines of treatment available are as follows:

1. Rest in bed; local applications of heat to the glands by means of fomentation, antiphlogistine, or radiant heat and the infra-red lamp.

2. Intramuscular injections of anthiomaline (10 to 20 injections), an antimony preparation.

3. Intravenous injections of sodium antimony tartrate.

4. Large doses of sulfonamide. The author began with sulfapyridine, giving as much as 96 gm., spaced over three or four weeks, in three courses. Careful watch on the white-cell count must be kept. Later on, because of the higher price of sulfapyridine, sulfanilamide was used in about the same amount, at roughly one-third of the cost. Still later on, some natives were treated with intramuscular injections of a suspension of sulfapyridine in water. This requires about one-quarter of the amounts stated earlier, and was seemingly just as successful.

5. Injections of triple typhoid vaccine—50 millions intravenously—about 6 injections at three-day intervals.

6. Surgical excision. The author tried this type of treatment in a small group of cases. Those in Stage I did well, healing by first intention and requiring about ten days of hospitalization and a week of convalescence. Early Stage II cases can be treated by excision too, but the wound is liable to become moist. In the brawny stage surgical intervention is contraindicated as the wound always breaks down.

JOHN A. LOEF, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Dennis, C.: Experience with Hematogenous Osteomyelitis in Children at the University of Minnesota Hospitals. *J. Lancet*, 1943, 63: 134.

The staphylococcus is by far the most important organism in osteomyelitis. Of 697 cases collected from the literature by Key, 89 per cent yielded the staphylococcus on culture; less than 5 per cent showed the streptococcus; 2½ per cent showed the pneumococcus, and 2½ per cent showed both the staphylococcus and the streptococcus; the remainder yielded the typhoid and influenza bacilli. Infants differ from other osteomyelitic patients in that they suffer from streptococcic infections twice as often as from staphylococcic.

One hundred twenty-two patients under twenty-one years of age were treated for osteomyelitis at the University of Minnesota Hospitals from January 1, 1938, to January 1, 1943. With regard to the management of fully developed acute osteomyelitis, opinions are divided into several groups, those advocating immediate radical surgery, those advocating operation after an interval of some days, those advocating nonoperative management with drainage of pus when it becomes apparent in the soft tissues, and those advocating nonoperative treatment throughout.

In acute osteomyelitis prophylaxis is possible to some extent in those patients known to have a low grade bacteremia, those who have drainage of abscesses, and those with furunculosis. In this group of patients, the likelihood of development of osteomyelitis should be considerably diminished by the administration of sulfathiazole for a period and the studious avoidance of trauma.

In a review of "Progress in Orthopedic Surgery in 1941," the American Academy of Orthopedic Surgeons concluded that neither complete conservatism nor radical surgery is in order. It favors conservative operative measures when indicated, and supportive measures, including plaster. This policy has many advocates. For several years the policy on the surgical service at the University of Minnesota Hospital was that of immobilization and elevation in plaster until pus became apparent in the soft tissues and demanded drainage. Twenty-eight cases of acute osteomyelitis in children treated in this fashion all went on to chronic osteomyelitis with the exception of 2.

Combinations of sulfathiazole and surgical intervention have been used by many surgeons for acute osteomyelitis, but there have been few cures. It is believed, however, that sulfathiazole helps to prevent the development of metastatic foci during surgical procedures. Sulfathiazole was used as the sole therapeutic measure, aside from bed rest, by Hoyt and his coworkers, in 8 cases. Diagnosis was established by roentgenograms, blood culture, aspiration of abscesses, or, more often, by two or more of these measures. Even when fluctuation indicated pus in the soft tissues, nonoperative management was continued and it was found that the abscesses usually resorbed without drainage. There were no deaths, only 1 case drained spontaneously, and 7 of the 8 patients were apparently healed completely at the time of the report. The blood levels were kept at about 3 to 4 mgm. per 100 cc. of blood for a period of some two months on the average. Since publication of the original article, this group has increased the number of cases to 17 with equally encouraging results.

Up to January 1, 1943, 5 cases of acute osteomyelitis have been treated at the University Hospitals with bed rest, with or without plaster, and sulfathiazole by mouth over fairly long periods. This treatment, initiated by Spink and Paine in April, 1940, has been used with some success since in a few cases, although the tendency has been to drain when roentgen-ray changes have occurred. Of 5 patients so treated, 4, all under five years of age, healed without going into the chronic stage, and in 1 the condition became chronic.

A still more recent development is the use of penicillin in the treatment of the disease. This drug is particularly valuable because many times the organism becomes resistant to the sulfonamides as shown by Spink. Florey and his group have given penicillin to 3 patients with osteomyelitis, with apparently some benefit in each of them. The chief drawback is the tremendous cost of the drug.

The majority of the patients suffering from chronic osteomyelitis have been treated in an expectant fashion, no drainage being done as long as incapacitation did not result. Sequestrectomies have been performed, whenever drainage or fever has increased and roentgen-ray evidence of sequestra has been present. Plaster immobilization has been employed whenever increased fever, tenderness, or drainage has been manifest. Although the number of patients in the younger age groups is small, it seems apparent that the condition of the younger patients with the chronic disease is not more favorable than that of the older ones, as is the case in acute osteomyelitis. This general impression is borne out under other treatments of the chronic disease also. A most impressive observation on this group has been the great likelihood of recurrence, even after years of remission.

Saucerization of bone plus implantation of sulfathiazole, followed by primary closure of the wound, was used in 6 children, 5 of whom are completely healed. Rapid and clinically complete healing occurred in 7 of 12 adult cases of hematogenous osteomyelitis but in no instance has the roentgen-ray

appearance returned to normal. Of 2 additional adults with chronic osteomyelitis resulting from fractures of the lower end of the femur, 1 has healed and 1 has not.

Seven patients with chronic osteomyelitis have been given bed rest and sulfathiazole by mouth for prolonged periods. In no instance has healing resulted, but in 2 cases with pain and no drainage the pain has been relieved. Finally, prolonged dependent drainage with "lucite" drains has been used in a series of 7 children and 5 adults. The period of healing seems to be between fifteen and eighteen months. Of 4 children in whom this therapy has been adequately applied, complete healing seems to have occurred in 3. This method is of particular value in sites in which insufficient soft tissues are present to fill the defect after saucerization and sulfathiazole implantation.

It seems justifiable to conclude on the basis of the figures presented and observation of the cases discussed that acute osteomyelitis in very young children is a more benign disease than it is in older individuals. It appears, also, that prolonged bed rest with plaster fixation and oral maintenance of a sulfathiazole blood level of from 3 to 5 mgm. per 100 cc. is the most effective measure in early acute osteomyelitis, regardless of the age of the patient. In the chronic disease, the choice would appear to lie between saucerization, sulfathiazole implantation, primary closure, and plaster on the one hand, and prolonged dependent drainage with lucite tubes on the other. A description of the progressive phases in osteomyelitis and the clinical picture of the acute and chronic forms are presented.

ROBERT P. MONTGOMERY, M.D.

Cobey, M. C.: Hemangioma of the Joints. *Arch. Surg.*, 1943, 46: 465.

The author has presented 4 more cases of hemangioma of the knee joint to demonstrate that this tumor occurs more commonly than is often appreciated, to point out how easy it is to mistake the tumor for any one of a number of conditions that affect the knee joint, and to reiterate the cardinal points in diagnosis.

In 1939 (Arch. Surg., 28: 487) George Bennett and the author reviewed the 24 reported cases of hemangioma of the knee joint, added 5 more, and proposed the use of roentgen therapy for tumors of the nonpedunculated type. Attempts at radical excision had proved unsatisfactory for this type of hemangioma. Too often the diagnosis of early tuberculosis of the synovial membrane of the joint or of some minor injury to the joint is made. In many instances the cardinal signs of a family history of hemangioma, hemangiomas elsewhere on the patient's body, and intermittent attacks of swelling and reduction of the size of the swelling of the knee on elevation of the extremity will make the diagnosis clear. The absence of any other positive findings in an apparently healthy patient should suggest a diagnosis of hemangioma. Aspiration as a diagnostic procedure is of little value. Biopsy is an important diagnostic aid. Roentgen examination may show phleboliths.

The treatment is excision for pedunculated tumors and roentgen therapy for extensive lesions involving the synovial membrane and capsule. The roentgen therapy usually requires about one week. The patient, however, should not be allowed to bear weight on the affected limb for three months after treatment is discontinued. This precaution should be taken because roentgen therapy may do damage to the growing epiphyses in a child. This risk, however, is not great.

Photomicrographs and case summaries are presented.

ROBERT P. MONTGOMERY, M.D.

Campbell, E., and Whitfield, R. D.: Osteogenic Sarcoma of the Vertebrae Secondary to Paget's Disease. *N. York State J. M.*, 1943, 43: 931.

Osteogenic sarcoma occurs not infrequently in patients with Paget's disease of bone. This tumor has been reported as having arisen in the long bones, the pelvis, and the skull. Despite the fact that the vertebrae are among the more frequent sites of predilection for osteitis deformans, malignant degeneration therein has seldom been recorded. The authors' recent observation of 3 such cases makes them wonder if this condition is as unusual as has hitherto been supposed. It therefore appears worth-while at least to call the attention of the profession to this experience.

Among the cases of compression of the spinal cord in Paget's disease—several instances of transverse myelitis of varying degrees have been reported. Many of these were associated with kyphosis and collapse of the vertebral body and others with marked local narrowing of the spinal canal by thickened bone, with little disturbance of its normal curvature. On the other hand, a careful search of the literature has revealed only 3 cases with sarcoma of the vertebrae. In each there were malignant tumors in other bones, so that it was difficult to determine which was the primary growth.

Sarcoma may arise from the vertebrae as well as from any other bone affected with osteitis deformans. Compression of the spinal cord and nerves follows quickly. Three such cases (one unconfirmed) are recorded. The first was a chondrosarcoma, the other an osteogenic sarcoma. These tumors are highly malignant. Radiation offers little or nothing, while resection is obviously out of the question. The spinal cord may be compressed by the buckling of vertebrae softened by osteitis deformans, unassociated with malignant degeneration. Hence laminectomy is often indicated, particularly if there is any doubt regarding the diagnosis. Under such circumstances, very satisfactory relief of symptoms has been known to follow. If, on the other hand, a sarcoma is discovered, some temporary benefit may follow decompression and from division of the involved posterior nerve roots. The prognosis in sarcoma of any bone secondary to Paget's disease is very poor.

Before recommending surgical intervention in any particular case, it is well to bear in mind that these patients are not good operative risks. Osteitis deformans is frequently associated with a marked degree of arteriosclerosis. Furthermore, the affected bones are quite vascular, and bleeding may prove troublesome, whether or not malignancy coexists.

ROBERT P. MONTGOMERY, M.D.

Albert, M., and Mitchell, W. R. D.: Volkmann's Ischemia of the Leg. *Lancet*, Lond., 1943, 244: 519.

Three cases in which there was ischemia of the anterior tibial group of muscles of the leg along with vascular injury are discussed. As a result of the ischemia and vascular injury there was foot drop, calcification, and abscess formation. The ischemia is described as being of the Volkmann type. The harmful results of a skintight plaster cast is stressed, as well as the importance of early surgical treatment if arterial occlusion is diagnosed. The calcification and abscesses may require surgical intervention.

RICHARD J. BENNETT, JR., M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

King, D., and Steelquist, J.: Transiliac Amputation. *J. Bone Surg.*, 1943, 25: 351.

Six cases are presented in which transiliac amputation for malignancy was performed. In all of these the lesion was too high to be treated by hip disarticulation. There was 1 operative death, 2 patients died in less than a year after the appearance of metastases, and 2 were alive at least nine months postoperatively. The postoperative photographs showed excellent healing and return to activity on crutches.

The author presents a fine series of photographs and sketches illustrating the steps involved in performing this hazardous procedure and the anatomical knowledge essential in order to obtain a satisfactory result. He stresses the importance of large blood transfusions before and during the operation. From the excellent results shown photographically it seems that this procedure will find more widespread use in selected cases. The article is an excellent contribution to the literature on amputations.

DANIEL H. LEVINTHAL, M.D.

Barr, J. S.: Muscle Transplantation for Combined Flexion-Internal Rotation Deformity of the Thigh in Spastic Paralysis. *Arch. Surg.*, 1943, 46: 605.

Cases of cerebral spastic birth palsy with a flexion-internal rotation deformity of the thigh show the predominant spasticity to affect the adductor muscles. Adductor tenotomy and obturator neurectomy considerably improve the gait of these patients. However, since the adductor magnus muscle is an important hip extensor, extension in the hip joint may be seriously impaired by the adductor tenotomy. Durham recommends tenotomy of the anterior portions of the gluteus medius and minimus and the tensor fasciae latae muscles for the relief of internal rotation deformity.

It is known that the antagonists of spastic muscles are weaker than normal. In the operation described by the author reinforcement of weakened abduction, extension, and external rotation, as well as decreasing the power of flexion and internal rotation, is taken into consideration.

In cases of severe adductor spasm, adductor tenotomy and obturator neurectomy are done before the operation is done. An incision is made extending from the posterior superior iliac spine to the anterior superior iliac spine following the iliac crest. The tensor fasciae latae and the anterior third of the gluteus medius and minimus muscles are freed en masse from their iliac origin. The leg with the knee extended is brought into 20 degrees of abduction, full extension, and in a neutral position as regards rotation. The freed muscle mass is pulled as far posterior to the coronal plane and as near to the iliac crest as possible. The bed for insertion of the muscle is prepared. A slot ¼ in. wide and 2 in. long is cut into the outer table of the ilium. The superior margin of the slot is gently levered outward after divergent cuts ½ in. long are made on each end of the slot. The traction sutures placed into the muscle mass are passed through drill holes in the outer table of the ilium. The muscle is then drawn into the slot and the sutures are tied while the leg is being held in the corrected position.

As soon as the wound is healed, assisted motion and gentle massage are instituted. Full weight bearing is permitted in from four to six weeks after the operation. A night splint may be used to keep the leg in the corrected position as long as it is deemed advisable.

The author obtained satisfactory results in every one of his patients operated upon for flexion-internal rotation deformity of the thigh, in the past ten years.

GEORGE S. REISS, M.D.

Abbott, L. C., and Gill, G. G.: Surgical Approaches to the Epiphysial Cartilages of the Knee and Ankle Joints. *Arch. Surg.*, 1943, 46: 591.

Many surgeons, including the authors, have adopted the method of Phemister in the operative arrestment of longitudinal growth of bones because of its simplicity and because it is a generally applicable procedure for children during the period of growth. In performing the operation, however, the authors have not found the straight incisions used by Phemister entirely satisfactory for the purpose of adequate exposure of these epiphysial cartilages. With this in mind, they have carried out special dissections in the anatomic laboratories which have resulted in the development of surgical approaches giving adequate exposure. The purpose of this article is to describe and illustrate these approaches.

In addition, a description of the surgical approaches to the epiphyses of the lower ends of the

tibia and fibula have been included because they contribute a certain amount of growth to these two bones. These approaches give adequate exposure for fusion of the cartilages and also permit due regard for the preservation of anatomic structures. Photographs of the various exposures are presented.

ROBERT P. MONTGOMERY, M.D.

Gaston, J. H.: Modified Bone Block for Paralytic Foot Drop. *South. M. J.*, 1943, 36: 336.

There are in some cases, in addition to other operative procedures, definite indications for a posterior bone block of the heel to control paralytic foot drop. This must be true because several orthopedic surgeons have devised various methods for accomplishing this. In most instances, the failures have been due to a painful heel and foot resulting from excess bone and spur formation or failure to accomplish the purpose resulted because of poor selection or placement of the block and at times absorption of the newly placed bone. These failures, in the author's opinion, are due to lack of proper control of the bone block at time of operation and in the postoperative or osteogenic stage. The author calls his procedure a modified bone block and subastragaloid arthrodesis by a controlled bone graft from the os calcis, the Achilles tendon being left attached and used as a pedicle to promote better circulation, and as a plastic flap to control, posteriorly, new bone formation.

From the standpoint of mechanics, a posterior bone block of the heel is a desirable procedure in selected cases of foot drop. The distal attachment of the Achilles tendon is exposed through a lateral incision that curves medially at the attachment. With a ½ in. hollow chisel a wedge-shaped section of the os calcis with the Achilles tendon attached is cut free. The foot is then placed in dorsal flexion and with the hollow chisel turned upside down, a smaller section of bone is removed from the astragalus, to leave a groove into which the graft from the os calcis is to be placed. A resection of the subastragaloid joint may be accomplished with this exposure. Care is taken not to remove or disturb tissue lying posteriorly to the ankle joint or at the lower end of the tibia. This is to avoid postoperative bone proliferation and, as the graft is cut with a sharp chisel and moved forward into the groove in the astragalus, there is no direct contact between raw bone or other disturbed tissue in the region of the ankle joint.

A graft from the os calcis is now placed in the groove of the astragalus with its proximal end at the desired height or angle to block the foot in a few degrees of equinus. The section of bone from the astragalus with smooth cartilaginous surface turned posteriorly, is now placed behind the turned-up section of the os calcis. A posterior flap of desired length is turned down from the Achilles tendon and sutured on each side to the remaining cut edges of the wide expansion of the insertion of the Achilles tendon. This restores the normal contour of the heel surface and makes a second attachment for the Achilles tendon. It also helps to control and gives conformity to any new bone formation that may take place posteriorly. Careful closure of the wound is made, and a cast is applied with the foot in slight equinus and the knee in a few degrees of flexion.

ROBERT P. MONTGOMERY, M.D

FRACTURES AND DISLOCATIONS

Anderson, R., and Burgess, E.: Delayed Union and Nonunion; 90 Per Cent Preventable. *J. Bone Surg.*, 1943, 25: 427.

The authors review a series of cases illustrative of the fact that reduction, immobilization, and preservation of the blood supply are essential for early union. It is their thesis that continuous traction contributes to nonunion because of distraction of the fragments. Plaster casts likewise contribute to nonunion because of inadequate immobilization, and open reductions interfere with the blood supply to the bone.

The authors describe in detail the fallacies of fracture treatment by the established methods, including even the newer methods as hanging casts and double-pin transfixion. It follows logically, so it would seem, that the only adequate reduction and immobilization results from half pin or double-pin units with external fixation control. A series of roentgenograms is shown illustrating the types of delayed union or nonunion complicating ordinary fractures and the successes resulting from half-pin unit fixation.

DANIEL H. LEVINTHAL, M.D.

ORTHOPEDICS IN GENERAL

Linsman, J. F., and McMurray, C. A.: Fluoride Osteosclerosis from Drinking Water. *Radiology*, 1943, 40: 474.

Although the medical and dental professions are well acquainted with the effects of fluoride-containing drinking water on the teeth—the development of dental fluorosis (mottled enamel)—the condition of osteosclerosis in the bones of human beings who have incurred mottled enamel from this source is not well known. No case of this kind has been reported in this country. The condition may have potential importance with regard to public health. All over the United States fluorides are being added to human diets. Fluorides are used in fruit sprays, in which they are mixed with casein and other binders to hold them on the fruit in spite of rain. These binders work so well that the fluorides continue to stick in spite of rather vigorous washing of the marketed fruit. The crushed phosphate rock which is applied to agricultural land and fed to farm animals usually contains fluorides as an impurity. Most of us, therefore, ingest a good deal of fluoride regardless of where we live. If it can be confirmed by studies like those of Linsman that the ingestion of more than a trace of fluoride is a dangerous thing, then perhaps something can be done about the whole-

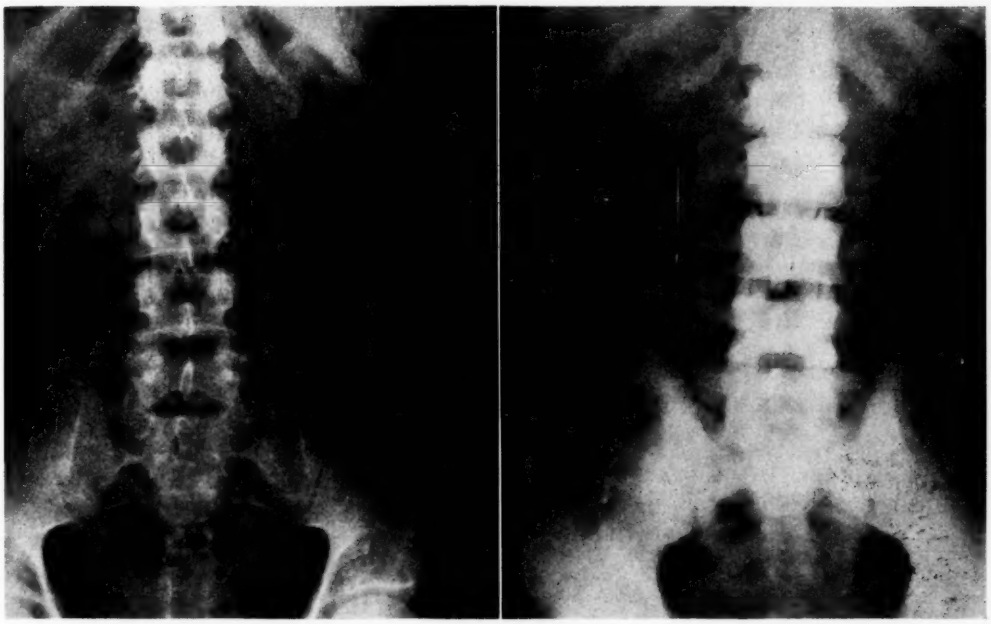

Fig. 1. Increase in density in the patient's lower ribs, lumbar spine, and pelvis (right), compared with the normal (left). The trabecular pattern is almost completely obliterated by this increased density.

sale unnecessary feeding of fluoride to consumers of fruit and of other agricultural products.

A case of osteosclerosis exhibiting, in addition, mottled enamel, severe anemia showing no response to antianemic therapy, and bilateral renal lesions, is reported. The diagnosis of fluoride osteosclerosis was proved by the history of a long residence in areas of endemic fluorosis and by fluorine analysis of the patient's bones and teeth. Osteosclerosis may be a dangerous sequel to the chronic ingestion of fluorine-containing water supplies, since it may give rise to a secondary anemia due to encroachment upon the blood-forming marrow. There is also the possibility of kidney damage due to the chronic fluoremia. Areas in the United States in which dental fluorosis exists and where the fluorine content of the drinking water is over 3 parts per 1,000,000 should be systematically studied by the public health authorities to determine how widespread the condition of osteosclerosis is. All patients with dental fluorosis and anemia and/or signs of renal impairment should have roentgenographic examinations of their skeletal systems to rule out the existence of fluoride osteosclerosis. No evidence of mottled enamel will be found unless the patient has ingested fluorine during the formative period of tooth enamel (from birth to eight years of age). Mottled enamel, therefore, will not necessarily be found among industrial workers coming in contact with fluorine compounds. The percentage composition of fluorine is greatest in the bones showing the greatest increase in bone density in roentgenograms. The fluorine may be deposited in these bones as a calcium or magnesium fluoride. In the differential diagnosis one must think of osteopetrosis (marble bones), metastatic cancer, and Paget's disease.

ROBERT P. MONTGOMERY, M.D.

Malkin, S. A. S., and Parker, G.: Rehabilitation in an Orthopedic Unit. *Brit. M. J.*, 1943, 1: 315.

The organization of an orthopedic unit consists of the parent hospital, the auxiliary hospital, and the rehabilitation annex. The relationship of these three units will be best appreciated by following the progress of patients with fractures of the tibia and fibula through these institutions.

Rehabilitation begins, not in a center, but in a hospital bed, and ends with the return to full pre-accident activity. All bed patients perform general and special exercises regularly. As soon as leg plaster cases are considered suitable for walking a soleplate is applied to the plaster. This consists of a wooden plate with heel and metatarsal bar, the heel and bar being shod with rubber. This allows heel-and-toe gait. Patients walk first with the aid of crutches and then with two sticks. They should retain their sticks until they are capable of walking with a normal gait. When a patient is walking satis-

factorily in plaster he is transferred to one of the auxiliary hospitals.

All patients in walking plasters, and those with fractures of the upper limb in and out of plasters go to the auxiliary hospitals. Here the day begins with general exercises in which all patients join. Later group exercises are carried out; these are directed particularly to the affected limb. Exercises are followed by and interspersed with organized games. Those not able to take part in organized games indulge in less energetic pastimes. At the auxiliary hospital the men are placed in jobs which have a therapeutic value. In addition to taking care of their beds and rooms they help in the kitchen and in the garden, mowing the lawns as well as weeding.

At suitable times the patient in plaster is returned to the parent hospital for review. The plaster is removed and the limb is examined and roentgen-rayed. If the fracture is not soundly united plaster is reapplied and the man returns to the auxiliary hospital. When union is sound the patient mobilizes the limb in bed for a few days and then walks under supervision of a masseuse. When he is walking satisfactorily he is transferred to the rehabilitation annex.

To the annex are transferred all cases of fracture out of plaster; fractured spines, both in and out of plaster, severe soft tissue injuries; and knee-joint injuries. The day is organized from 8.30 a.m. to 4.30 p.m. Work begins at 8.30 a.m. with half an hour of general physical therapy in which all the men join. Following the communal exercises the men are split into groups according to their capacities and sites of injuries. One group may have graded exercises; the second, resistance exercises; and the third group, remedial games. All treatment is liberally interspersed with rest periods. The muscles should never be overtired and the patients should be hurt as little as possible. Treatment can proceed with minimal discomfort with graduated exercises, radiant heat baths, massage, novocaine injections, and manipulation. The morning work ends with a period of organized games or swimming before lunch. In the afternoon a similar program is carried out, games taking a larger proportion of the time until 4.30 p.m. Then the men are free.

Medical supervision of the occupational-therapy departments is best done by a member of the surgical team. The patients are more willing to be spurred on by the surgeon who has already had them under his care. DAVID IMPASTATO, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Douglas, B., and Buchholz, R. R.: The Blood Circulation in Pedicled Flaps. *Ann. Surg.*, 1943, 117: 692.

New methods are described for determining the systolic blood pressure in double and single pedicled tube flaps of skin and subcutaneous tissue.

Blood pressures were found to be low shortly after formation of the flaps and gradually increased with the passage of time until at two weeks they approached normal systolic brachial pressures.

The growth of hair is moderately retarded on pedicled flaps up to three weeks after their formation, which seems to indicate a temporary slight disturbance of the circulation.

Application of the Brooks' thermocouple apparatus, a test called the "temperature-return test," has been developed for determining the efficiency of the circulation in tubed flaps. In dogs it reveals an increasing circulatory efficiency from the time of the formation of the flap until the sixth or seventh day, at which time the circulation through either pedicle to the other end appears to reach almost a maximum efficiency. At this time safe transfer of a pedicle may be accomplished.

In dogs and human beings, curves indicating the efficiency of the blood circulation in flaps have been correlated with the ability of the flap to completely survive surgical transplantation.

Evidence accumulated from a number of human cases appears to indicate the advantages of this physiological test in individualizing the circulatory efficiency of the flap so as to save time, with safety, between stages, and to avoid the discomfort for the patient incident to well meant unnecessary delays. In war surgery the importance of this point is obvious. JOHN J. MALONEY, M.D.

Luke, J. C.: Mesenteric Venous Thrombosis; Treatment with Heparin. *Lancet*, Lond., 1943, 244: 552.

Collected series of cases of mesenteric venous thrombosis show it to be the most lethal of causes of bowel obstruction, and that the chance of survival is nil without operation. The operative mortality is high, and the main factor appears to be a continuation of the thrombotic process beyond the limits of the resected bowel. Experiences of some investigators have been that postoperative heparinization was of value in preventing extension of thrombosis in the mesenteric vessels. In early cases of mesenteric venous thrombosis, in which it could be shown that the involved bowel was still viable, the author believed that the use of heparin alone would be of value, and he reports a case in which this plan was adopted, with success.

The patient, a forty-two-year-old army private, previously in good health, was stricken with epigastric distress of increasing severity and accompanied by nausea and vomiting. On examination he was writhing about in bed. He was not in shock. The abdomen showed generalized tenderness with no rebound pain and no audible peristalsis. There were no masses and no hernias, and the rectal examination was negative. X-rays revealed a distended small-bowel loop on the flat film, and several marked fluid levels, in the upright one. White cells numbered 5,800 per cc. Laparotomy was done under pantocain spinal anesthesia and it revealed a segment of small bowel 4½ feet long, about 6 feet from the duodenojejunal junction which was purple and distended but with its peritoneal surface intact; no petechiae were present. Peristalsis was absent. Arterial pulsation was present but the veins in the mesentery were dark purple and felt firm, which indicated a definite thrombosis. The superior mesenteric vein was not palpable. Early mesenteric venous thrombosis was diagnosed, and the abdomen was closed with the plan of treating this case with heparin alone. Ten thousand units of heparin in saline solution were given intravenously and the administration was continued daily for the next ten and one-half days. The blood coagulation time was maintained mostly between 15 and 26 mm. The temperature at no time rose above 100° F. and the pulse remained below 90. The second stool passed after operation was strongly positive for blood; the subsequent stools showed decreasing amounts. Except for a hematoma in the wound convalescence was entirely uneventful.

As a possible means of reducing the present high mortality the author suggests further trial of heparinization without resection in those cases of mesenteric venous thrombosis seen before serious intestinal infarction has taken place and in which the bowel is definitely viable. EDWIN J. PULASKI, M.D.

BLOOD; TRANSFUSION

Duran-Jorda, F.: The Formation of Red Blood Corpuscles. *Lancet*, Lond., 1943, 244: 513.

The author expresses his conception of the evolution of blood formation. His conviction is that the red blood corpuscle is not a product of cellular evolution but one of cellular secretion. He has come to this conclusion because the commonly accepted explanation of its origin is unconvincing. For instance, it is a strange fact that no investigation in any part of the body has revealed the normoblast in the act of expelling the free nucleus. On the other hand, if the theory that the nucleus is dissolved in the protoplasm is accepted, karyolysis of the nucleus has never been seen in any portion of the body. Moreover, the different forms and shapes of the red blood corpuscles and their different sizes are puzzling and unexplained facts when one considers that

all of the cells come from one and the same ancestor. Another factor which has never been fully understood is the easy way in which blood is replaced after a blood donation and severe anemia. This recovery is particularly striking when it is compared with the time taken to remake the same weight of any other tissue. Another important point is that although it is accepted that the hematocytoblast, normoblast, and megaloblast have developed from connective tissue, no case of sarcoma of any of these cells has ever been reported.

If the evolution theory is considered in animals, we find that the scale of blood development follows an order which appears absolutely illogical. In the insects and invertebrata, the blood pigment is in solution in the circulating fluid and has no cells acting as pigment carriers. Further up the animal scale, in fishes and birds, there is a nucleated red blood corpuscle which has the characteristics of a cell. Although mammals live under much better conditions of oxygen supply than fishes and birds, they have a non-nucleated red blood cell. Yet one mammalian red blood corpuscle is thought to be produced by the evolution of one cell in about four stages, a process which appears unnecessary in the light of the aforementioned facts. The female mammal recurrently loses blood in menstruation and parturition. It is difficult to understand why nature should dispose of this blood after the supposedly complicated process undergone in its production. Before birth, nature uses the blood of the mother to nourish the fetus. At birth, lactation begins and nature solves the problem of feeding the newborn child with a fluid which is almost identical with blood. The aforegoing observations led the author to the conclusion that the red blood corpuscle is not a cell.

This idea of the evolution of the blood corpuscle led him to the study of embryology. The author finds that the nucleated red blood corpuscle is not a cell as has been accepted but as a complex within a cell. This original cell he terms the "stem" cell. Its characteristics are described. The finding of the stem cell led to the understanding of the function of plasma cells all over the body because of their similarity to the immature stem cell. The stem cell which secretes the red blood corpuscle has been seen by many observers, but the process has been wrongly described as phagocytosis of the red blood corpuscle. The author has found cells of this type in the spleen, in the liver blood-sinuses of a fetus, in the thymus, thyroid, and interstitial mucosa, in multiple pathological processes in which the plasma cell is evident, and also in the lymph glands.

The author changed his technique of examining the bone marrow and found different cells in it. These stem cells are observed to have three components: viz., (1) the spheroidal bodies, which contain the hemoglobin and are the accepted red blood corpuscles, (2) the small fragments of protoplasm from other parts of the cell which have a granulated appearance, some of which are floating around free and others becoming attached to the other bodies, and (3) the nucleus of the broken cell with its cart-wheel formation, surrounded by a small halo of protoplasm. It is the opinion of the author that from these three components come the red blood corpuscle and protoplastic granules which are platelets. The formation of the red blood corpuscle as a secretion logically explains their different sizes and shapes, and the different inclusions found in them in different diseases. It appears to him that the lymphocyte may have a cycle of evolution in which it develops as a plasma cell, afterward becoming a stem cell which subsequently bursts and throws out its products, and finally becomes a lymphocyte again.

As a result of these investigations the author presents the following conclusions:

1. The red blood corpuscle is formed from the plasma cell. As the plasma cell occurs all over the body one must assume that the red blood corpuscle can be formed all over the body and not only in the bone marrow as is currently supposed.

2. The red blood corpuscle is a secretion of the plasma cell and is formed when the plasma cell disintegrates.

3. When the plasma cell disintegrates the nucleus is extruded with a small halo of protoplasm and this exists as an independent cell, corresponding to what is currently known as the normoblast.

4. The red blood corpuscle is a simple droplet of colloidal nature and is in some respects similar to the fat globules in the milk.

5. The accepted lymphocyte is really a stage in the development of the normoblast.

6. The platelets are really protoplasmic remnants of the original plasma cell which has broken up.

HERBERT F. THURSTON, M.D.

Newman, B., and Gitlow, S.: Blood Studies in the Aged. The Erythrocyte in the Aged Male and Female. *Am. J. M. Sc.*, 1943, 205: 677.

The authors note that the ascorbic-acid content of the aged individual is far from the ideal. It has been shown that an anemia may result from a deficiency of vitamin C. Moreover, when scorbutic patients have an anemia, iron and liver therapy produces little or no effect on blood formation but marked results are obtained from the addition of further vitamin C to the diet.

In view of these findings, the authors thought it of interest to investigate the hematology of the normal aged individual. The techniques employed in these investigations are described in detail. Tabulations are presented which give the experimental and calculated values for a group of 50 men whose ages ranged from sixty to ninety-one years, the average being seventy-eight and three-tenths years; the experimental and calculated values for a group of women whose ages ranged from sixty-six to one hundred and four years, the average being seventy-seven and two-tenths years; the experimentally determined and computed values of various age

groups; the comparison of results obtained by these investigations; and the comparison of results in males and females.

In conclusion, the authors state that determinations were made of the hemoglobin, the erythrocyte count, the volume of packed cells, the reticulocyte count, and the resistance of the red cells to hypotonic salt solutions in a group of 100 individuals past sixty-five years of age. The color index, volume index, saturation index, the mean corpuscular volume, the mean corpuscular hemoglobin, and the mean hemoglobin concentration were computed.

Comparisons were made with "normal" volumes reported by other observers. It was found that the physiological "normals" should be modified when dealing with aged individuals.

There is a statistically significant difference between the male and female values as determined by the authors for hemoglobin, red-cell count, hematocrit readings, volume index, mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration.

HERBERT F. THURSTON, M.D.

Pennell, S.: A Platelet-Red-Cell Conjugation Phenomenon and Its Relation to Blood Coagulation. *Am. J. M. Sc.*, 1943, 205: 562.

Pennell calls attention to a conjugation phenomenon between the blood platelets and red cells which may readily be observed in normal freshly shed blood, both in dried stained smears and in moist preparations. When the platelets lie in contact with the red cells, deformity of the red cells anywhere from slight indentation to complete division can be seen. The phenomenon is strictly a selective one which takes place only between the red cells and platelets. Leucocytes never become involved in the process. If the blood is citrated, practically no deformed red cells can be seen; the platelets do not agglutinate and they apparently lose their stickiness. Fresh heparinized blood also shows a marked diminution of the red-cell-platelet conjugation. If a rabbit is heparinized sufficiently to produce a marked prolongation of the coagulation time, smears of the blood also show a marked diminution of the red-cell-platelet conjugation. When the effect of the heparin has worn off, the red-cell-platelet conjugation can again be demonstrated.

Blood from cases of thrombocytopenic purpura and hemophilia were studied. Although the platelets are greatly reduced in number in thrombocytopenic purpura, the red-cell-platelet conjugation is relatively increased rather than diminished in relation to the numerical reduction of the platelets. In cases of hemophilia, when the coagulation time is prolonged, preparations of the blood consistently show marked diminution of the red-cell-platelet conjugation as compared to normal blood. The moist preparations of hemophiliac blood resemble very closely those of citrated and heparinized blood.

The significance of this conjugation phenomenon in blood coagulation is discussed. For blood to clot, a sudden and massive disintegration of platelets appears to be necessary. The conjugation between red cells and blood platelets is regarded by Pennell as a means by which the platelets can employ the surfaces of the red cells for the contacts necessary to carry out this mass disintegration. The author believes that the reduction in platelets which normally occurs as the blood passes through the systemic capillaries may be due to a limited amount of red-cell-platelet conjugation which takes place during the transit of the blood through the capillaries. The fact that the hemophiliac's platelets have been shown to be normal in various ways would seem to indicate that the hemophiliac's red cells may be responsible for the diminished red-cell-platelet conjugation in this disease.

EDWIN J. PULASKI, M.D.

Hirschboeck, J. S., and Coffey, W. L., Jr.: Clot Retraction Time in Thrombophlebitis and Pulmonary Embolism. *Am. J. M. Sc.*, 1943, 205: 727.

Hemodynamic factors, local tissue, and vascular trauma are of great importance as causative factors in the development of phlebothrombosis and pulmonary embolism, but anemia and elevation of the blood fibrinogen and platelet levels are also of major importance, and all of these working together result in a rapid and powerful clot retraction. The strength and rapidity of clot retraction are perhaps responsible for the loosening of thrombi from vessel walls and explain the coincidence of short clot-retraction times with the occurrence of pulmonary embolism. Small amounts of heparin greatly prolong the clot retraction time, and the authors believe that the prophylactic use of heparin in patients with short clot-retraction times should reduce the incidence of pulmonary embolism. J. M. MORA, M.D.

Kracke, R. R., and Townsend, E. W.: The Effect of Sulfonamide Drugs on the Blood Platelets. Report of 2 Cases of Thrombopenic Purpura, and Experimental Studies on Patients Receiving Sulfonamide Drugs. *J. Am. M. Ass.*, 1943, 122: 168.

In patients treated with the sulfonamide compounds, the blood platelets may occasionally be depressed to the extent of producing severe thrombopenic purpura.

Fonio's method of estimating blood platelets is simple and sufficiently reliable to be preferred as a routine procedure. It consists of puncturing the finger, and at once placing a drop of 14 per cent magnesium sulfate over the puncture before the blood begins to flow. The blood is permitted to flow into the drop until the proportion is about one part of blood to one part of magnesium-sulfate solution. A small drop is then placed on a slide and a thin smear is made. The magnesium sulfate is wiped away and an ordinary red-cell count is made by the usual technique. The smear is stained with Wright's stain, and the platelets are counted with the oil-immersion objective until 1,000 red cells in various microscopic

fields have been simultaneously enumerated. From these data the number of platelets is computed. In the group of 27 normal persons, the average platelet count was 351,000 per cubic millimeter.

Daily platelet counts in normal persons over a period of ten days revealed decided variations in the number of platelets in the same individual. In 61 patients treated with sulfathiazole, daily platelet estimations revealed a slight platelet depression on the first day of treatment, and a decided increase of platelets on the first day after cessation of treatment.

The fact that the sulfonamide compounds appear to be capable of depressing platelets in an occasional person makes it all the more important that these drugs should be used with caution, under the supervision of physicians, and that hematological studies should be made frequently to determine any untoward effects on the blood. SAMUEL KAHN, M.D.

Haffly, G. N.: Preoperative Detection of a Bleeding Tendency in Patients with Otolaryngological Disorders. *Arch. Otolar.*, Chic., 1943, 37: 622.

Three established cases of hemophilia are presented, in each of which there existed a remarkable discrepancy in the coagulation time of the capillary blood as compared with that of the venous blood when similar tests were exmployed.

The Lee and White method of measurement of coagulation time, employing venous blood, is a delicate test of extreme value in determination of the clotting time, provided such blood has been secured without trauma and the admixture of tissue juices.

Unless the family, personal history, or the physical signs are suggestive of a bleeding diathesis, routine tests of the clotting mechanism of the blood are not indicated.

If the family, personal history, or the physical signs are suggestive of a bleeding diathesis, the following tests are to be considered of diagnostic value: (1) determination of the venous coagulation time (preferably by the Lee and White method); (2) the Duke method for measurement of the bleeding time; (3) clot retraction determinations; (4) the capillary resistance test of Rumpel and Leeds; (5) platelet count, and, in selected cases, (6) the determination of the prothrombin time.

The more advanced and technically difficult tests of a quantitative nature fall in the domain of the larger private and hospital laboratories. These include the quantitative determination of (1) fibrinogen, (2) serum calcium, and (3) antithrombin. The clinical value of determinations of the latter two factors is questionable.

In certain cases in which a bleeding diathesis exists, the results of all diagnostic blood tests may be normal and yet the patient may suffer fatal hemorrhage after a surgical procedure. This is true particularly in the condition known as hereditary thrombasthenia (hereditary pseudohemophilia), in which the family and the past history are frequently more important than the evidence from diagnostic tests. In all cases of such disease one must proceed with extreme care despite the lack of any positive diagnostic evidence of a bleeding tendency. Every precaution must be utilized, including the preoperative typing of the blood of the patient and that of his immediately available donors.

JOHN F. DELPH, M.D.

Anderes, E., and Laszczower, M.: New Method of Reinfusion of Peritoneal Blood. New Technique of Suction of Fluids from Body Cavities (Eine neue Methode der Reinfusion des Bauchhoehlenblutes. Gleichzeitig Beitrag zur Technik des Absaugens von Koerperhoehlenfluessigkeiten). *Schweiz. med. Wschr.*, 1942, 72: 933.

There is no unanimity of opinion as to whether blood collected from the peritoneal cavity in cases of ectopic pregnancy should be placed back into the circulation. A compromising point of view is taken by some surgeons who advocate a reinfusion under certain circumstances. The main drawback of a reinfusion is the cumbersome technique.

The authors attempted to develop a method which avoids as much as possible a contact of the blood with the air. A suction apparatus carries the blood from the peritoneal cavity through a filter directly into the container for blood transfusions. In this manner contact with the air and danger of a secondary infection are avoided. The metal filter is surrounded by a cap which prevents an aspiration of intestinal coils or omentum. Fifty cubic centimeters of a 4 per cent citrate solution are placed into the container for the blood. As a rule 500 cc. of blood are transfused. The flexible attachment of the filter in form of a rubber tubing allows evacuation of the blood from various parts of the abdominal cavity, without lifting or tilting the patient's pelvis. Blood coagula are removed from the pelvis because they favor the formation of adhesions. The blood is transfused during or immediately following the operation. The authors employed their method successfully in 15 cases.

If the blood is coagulated or too old, as in the case of hematocele, or if an inflammation of the abdominal organs is present, the autotransfusion is replaced by a transfusion of blood from a donor. In case of necessity the authors do not hesitate to use blood from a universal donor. JOSEPH K. NARAT, M.D.

Dacie, J. V., and Mollison, P. L.: Survival of Normal Erythrocytes after Transfusion to Patients with Familial Hemolytic Anemia (Acholuric Jaundice). *Lancet*, Lond., 1943, 244: 550.

Dacie and Mollison estimated the survival time of normal blood transfused into 6 patients with familial hemolytic anemia. In all 6 cases the classical features of splenomegaly, anemia, spherocytosis, increased fragility, reticulocytosis, and hyperbilirubinemia were present. To estimate the transfused erythrocytes, differential agglutination tests were made with the recipients' cells and type-specific antisera; the unagglutinated donors cells could then be counted. In all 6 cases group O blood was used for

the transfusion; in 5 cases the recipient belonged to group A; and in Case 3 the recipient belonged to group O. The differential agglutination was carried out by means of an anti-M test serum.

It was found that the rate of disappearance of normal cells after transfusion into 5 of the 6 patients with active typical familial hemolytic anemia was between one hundred and one hundred and thirty days, or about the same as in normal subjects. In Case 3 destruction was more rapid, and was complete in about sixty days. In this case further study revealed that the patient was Rh-negative (the other 5 patients were Rh-positive); the donor blood was Rh-positive, and following its disappearance from this patient's circulation, anti-Rh agglutinins appeared in the serum.

In a control series of 5 cases of hemolytic anemia of varied types (pregnancy, tuberculosis, sulfonamide toxicity) cell destruction was always rapid and usually complete within twenty days following transfusion.

Blood taken from a patient with familial hemolytic anemia both before and after splenectomy and transfused into a normal recipient was completely eliminated within fourteen days of transfusion.

In discussing their results, the authors state that they believe their observations support the hypothesis that the basic abnormality in familial hemolytic anemia is the formation of erythrocytes (spherocytes) with an increased tendency toward hemolysis rather than a possible major destructive mechanism.

EDWIN J. PULASKI, M.D.

Mollison, P. L.: The Investigation of Hemolytic Transfusion Reactions. *Brit. M. J.*, 1943, 1: 529.

A hemolytic transfusion reaction is defined as the occurrence of an abnormal destruction of red blood cells of the donor or recipient immediately after transfusion. The purpose of this report is to discuss the pathological features of different types of hemolytic reaction and to describe methods of differential diagnosis.

The diagnosis is dependent upon the demonstration of the occurrence of increased blood destruction and of its cause. The signs of increased blood destruction vary according to whether destruction is predominantly intravascular or extravascular (intracellular).

Intravascular destruction liberates hemoglobin into the plasma. This hemoglobin may be disposed of in three ways:

1. It may be absorbed by the reticuloendothelial system and be transformed to bilirubin, which is then excreted by the liver.

2. When intravascular hemolysis is of greater degree part of the hemoglobin is broken down intravascularly and hematin is liberated, which combines with serum albumin to form methemalbumin.

3. Some hemoglobin is excreted by the kidney, but only when its concentration in the plasma exceeds a certain level. Once hemoglobinuria has begun it may persist even when the plasma hemoglobin level has fallen far below the initial renal threshold, so that hemoglobinuria may persist for twenty-four hours or more after transfusion.

Following intravascular hemolysis, some degree of renal failure may occur with oliguria and increased blood urea concentration. Signs of uremia due to renal damage may not become apparent until the second or third day after the transfusion. Meanwhile the recipient may appear well. After that, usually between the sixth and twelfth days, the patient may become critically ill and comatose, and die, or else start passing large quantities of urine and recover.

Extravascular hemolysis produces bilirubin and the degree of bilirubinemia depends upon the rate of blood destruction and upon the ability of the liver to remove the bilirubin from the blood stream.

Certain signs of blood destruction may be demonstrated as the result of either intravascular or extravascular destruction. These are: jaundice due to bilirubinemia, absence of the expected rise in hemoglobin concentration after transfusion, and fever with or without rigor. However, one must remember that a hemolytic transfusion reaction may occur without giving rise to any symptoms.

Hemolytic transfusion reactions may be due to any one or more of several factors. Incompatible red cells may be either agglutinated or hemolyzed by the recipient's plasma. The chief factors affecting the mode of destruction probably are the titer of the incompatible agglutinins in the recipient's plasma and the rate of transfusion. The rate of destruction of red cells of stored blood in the recipient's plasma after transfusion depends upon the length of storage, the preservative used, and the temperature of the environment. Blood cells which are stored in a simple solution of sodium citrate do not survive nearly as well as cells which are stored for the same period of time in a solution to which glucose has been added. Blood hemolyzes more rapidly at room temperature than at 5° C. and the survival power of the cells is much less when they are exposed to room temperature for a prolonged period of time. Hemolytic reactions may result from the destruction of the recipient's red blood cells by high-titer incompatible agglutinins in the donor's plasma. Patients with hemolytic anemias may have an exacerbation of the hemolytic process following a blood transfusion. Blood may become hemolyzed by the action of contaminating organisms, by being overheated, or by being stored for prolonged periods under unfavorable conditions.

The investigation of a transfusion reaction suspected of being hemolytic is greatly facilitated if one possesses a sample of the donor's blood and a pretransfusion sample of the recipient's blood. These should be obtained as a routine and kept for a period of twenty-four hours after every transfusion. When the patient is seen within twenty-four hours of a suspected hemolytic transfusion reaction, a large sterile sample of venous blood and a clean sample of urine should be obtained.

The following tests may be necessary in the investigation of an obscure case of suspected hemolytic reaction:

1. The donor's blood sample should be subjected to bacteriological examination; it should be centrifuged to determine the amount of free hemoglobin in the supernatant plasma; it should be regrouped and the Rh group of the cells should be determined; it should be tested against the recipient's serum, with the pretransfusion sample of the latter; and the titer of agglutinins in the donor plasma should be estimated.

2. The post-transfusion sample of the recipient's blood should be subjected to bacteriological examination; the serum from a clotted sample should be examined for hemoglobin or excess bilirubin and subjected to serological tests, including particularly differential agglutination tests. An oxalated sample should also be subjected to serological tests and a portion of it should be centrifuged to permit examination of the plasma for pigments, as a check on the serum examination.

3. A sample of the recipient's urine should be examined for color, spectroscopically for oxyhemoglobin and methemoglobin, and for the presence of urobilin. A sample should be centrifuged and the deposit examined for the presence of pigment casts. The usual tests for reaction, specific gravity, and albumin should also be carried out.

EDWARD W. GIBBS, M.D.

Mollison, P. L.: Investigation of Hemolytic Transfusion Reactions. *Brit. M. J.*, 1943, 1: 559.

In a recent earlier report the author described a large number of tests for use in the investigation of hemolytic transfusion reactions. The procedure should be to test for the most likely cause first and to apply other tests only when the first ones are negative or inconclusive. Twelve case records are presented to illustrate some of the methods of investigation. The diagnosis of hemolytic reaction is based on evidence of increased blood destruction following transfusion and on the demonstration of a cause for this destruction. The most common causes of severe hemolytic transfusion reactions at the present time are: (1) mistakes in blood grouping; (2) the use of Rh-positive blood for transfusion to recipients sensitized to the Rh agglutinogen; and (3) failure to maintain adequate standards in blood storage.

The investigation of hemolytic transfusion reaction is greatly facilitated if a sample of donor blood is kept available for investigation for at least twenty-four hours after the transfusion, and is further facilitated if a pretransfusion sample from the recipient is also kept available for testing. When the patient is seen within twelve or twenty-four hours of transfusion the increased destruction can often be demonstrated by simply obtaining a venous sample from him and showing that it contains oxyhemoglobin, methemalbumin, or an increased concentration of bilirubin. When the patient is seen later, the application of the method of differential agglutination is often the only way of demonstrating that the donor's red cells have been rapidly destroyed. Valuable additional evidence can often be obtained by demonstrating the presence of immune agglutinins in the recipient's serum.

It should be possible to diagnose the cause of practically all hemolytic transfusion reactions provided that investigations are initiated a short time after transfusion, and provided that a sample of the transfusion fluid is available for testing. In practice, however, these conditions are often not fulfilled, and the cause of many hemolytic reactions is, therefore, never determined. It is considered that the full investigation of these reactions would be one of the most effective ways of raising the standard of blood transfusion.

HERBERT F. THURSTON, M.D.

Stratton, F.: Some Observations on Autohemagglutination. *Lancet*, Lond., 1943, 244: 613.

Autohemagglutination is a term applied to the clumping of erythrocytes into irregular masses, visible to the naked eye and occurring in the presence of the individual's own serum without bacterial action and at air temperature, the action being reversible at body temperature.

The case histories of 5 patients in whom pathological autohemagglutination was observed are presented. The blood of 3 of the patients belonged to blood group A; that of case 4 to group B, and that of case 5 to group O. It was possible to absorb the agglutins responsible in each case for the autoagglutination with group O cells at low temperatures. By washing these cells the responsible agglutinins were recovered in saline solution. This solution was titrated against cells of A_1, A_2, B, and O types, and at 20° C. Anti-O agglutins were demonstrated in cases 1, 2 and 3. The agglutinin solutions from cases 4 and 5, however, attacked all cells, but those of group O more strongly, while cells of other groups showed a slightly lower titer.

In no case was agglutination present at 37° C., which showed that the results were not due to the presence of any residual anti-A or anti-B agglutinins. The autoagglutinating property was not destroyed at 56° C. for thirty minutes. It was found further that on the addition of specific polysaccharides present in saliva, isoagglutinins alpha and beta could be removed so that the antiagglutinins could be isolated. The red cells in these 5 cases failed to show any abnormality. The methods for isolating and examining the abnormal agglutinins are presented in detail in the article.

EDWIN J. PULASKI, M.D.

Hudson, C. B.: A Rapid Method for Crossmatching of the Blood of Donor and Recipient. *Med. J. Australia*, 1943, 1: 362.

A method is described for the rapid crossmatching of the blood of the donor with that of the recipient in circumstances in which the recipient's serum or plasma cannot be obtained quickly. Hemolyzed blood is used instead of serum or plasma. The

blood is hemolyzed by being frozen with ethyl chloride, and is subsequently thawed.

Specimens of hemolyzed blood from 400 subjects were crossmatched with compatible and incompatible red-cell suspensions, and the method was found to be reliable. SAMUEL KAHN, M.D.

RETICULOENDOTHELIAL SYSTEM

Emmett, J. M., and Dreyfuss, M. L.: Accessory Spleen in the Scrotum. *Ann. Surg.*, 1943, 117:754.

The authors report a case of ectopic spleen in the scrotum which is sufficiently rare to warrant the report.

The patient complained of a lump in the right groin. However, on examination, in addition to a right indirect inguinal hernia, a smooth, round, nontender, firm mass was found attached to the upper pole of the left testicle. The left testicle was normal in size and consistency. At operation the left scrotum was incised and the tumor was removed by sharp dissection. The pathological examination revealed a gland covered by a dense, pearly-gray capsule, 4 by 3.5 by 2 cm., which on cut section revealed brownish-red tissue and fine trabeculae. The microscopic section showed normal splenic tissue.

Putschar has collected several cases of ectopic spleens with bands between the spleen and genital organs. One case each has been reported by Fischer and Gissel, Finlay, Talmann, Osseladore, and Settle. All of the ectopic spleens were found in the left scrotum; some were associated with undescended testicle and some with inguinal hernia. In each of the cases of ectopic scrotal spleen not associated with a congenital malformation, reported by Talmann and Settle, the patients complained of painful enlargement of the left testicle during the acute febrile phases of tertian malaria.

In a collective summarization of the literature reporting spleens in anomalous locations, the authors classify the following types: (1) wandering spleen; (2) double spleen; (3) multiple spleen (10 to 400); and (4) accessory (aberrant or ectopic) spleen. These types differ from each other in their formal genesis as well as in their clinical significance.

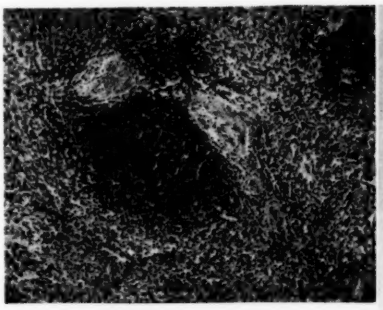

Fig. 1.

Fig. 2

Fig. 1. Photomicrograph of section from paratesticular tumor showing characteristic splenic tissue.

Fig. 2. Band of splenic tissue connecting the normally located spleen, with an accessory spleen in the scrotum. (Redrawn from Sneath.) (Courtesy of J. B. Lippincott Co.)

During intrauterine life, most probably from the sixth to the eight week, splenic tissue is already well developed and is still in close contact with the wolffian body when the caudal migration of the left genital gland begins. Splenic tissue then accompanies the genital gland in its descensus and is found in the scrotum in close association with the epididymis or, in the female, with the region of the mesovarium.

The authors express the opinion that this malformation occurs more frequently than the recorded cases would indicate, but that it is either erroneously interpreted or not published.

JOHN E. KIRKPATRICK, M.D.

SURGICAL TECHNIQUE

WAR SURGERY

Cairns, H., and Holbourn, H.: Head Injuries in Motorcyclists, with Special Reference to Crash Helmets. *Brit. M. J.*, 1943, 1: 591.

The effectiveness of crash helmets in alleviating the head injuries of motorcyclists has been studied. Two main varieties of helmets are in use: one composed of vulcanized rubber, and the other of compressed wood pulp (Figs. 1 and 2). The crash helmets, and usually the patient, have been examined in 106 accidents. The severity of the head injury was judged by the duration of the amnesia. Marks on the helmets were studied and were found to correspond with the location of the injury to the underlying scalp and skull. In 40 per cent of 81 cases the helmet showed marks of more than one blow. Blows on the frontal quadrant of the helmets are most frequent, and the majority of blows are at or fairly near the edge of the helmet. These observations show the importance of design in providing good protection especially in these areas. Blows over the temporal region were more dangerous than frontal blows, while the effects of blows in the occipital region were milder than either. Vertebral fractures are not common in motorcycle accidents but should be looked for when the blow is on the crown of the head. There were only 9 cases in the series in which the helmet did not bear any marks of a blow, and there was evidence of a blow on the head in all but 4 patients.

These observations establish the fact that in motorcyclists, brain injury is almost invariably associated with a blow on the head, protection against which can be provided by a properly fitting crash helmet. The theory of the mode of action of crash helmets is that they diminish local injury in the region of the blow by distributing the force over a wider area and "lengthening the blow" so that it is not so intense at any particular instant. Of the two types of crash helmets, the pulp helmet is superior to the vulcanized rubber helmet. The incidence of fractures of the skull and of prolonged amnesia is diminished by the use of crash helmets.

JOHN L. LINDQUIST, M.D.

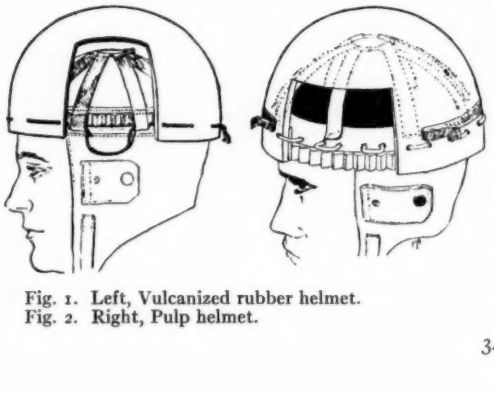

Fig. 1. Left, Vulcanized rubber helmet.
Fig. 2. Right, Pulp helmet.

Pinnock, D. D., and Wood, P.: Blast Injury to the Abdomen by Depth Charge. *Brit. M. J.*, 1943, 1: 537.

Persons swimming in the water close enough to an exploding depth charge may suffer blast injury to the abdominal viscera, characterized by shock, hematemesis, melena, and pyrexia. Recovery may take place without surgical intervention. Perforation of the gut may sometimes be successfully treated by surgical repair. Many of these patients have died before conditions were suitable for careful study or surgical help. Associated blast injury to the lungs is common.

Five cases are reported. All 4 patients who had injuries to the intestines died, which suggests a worse prognosis than that indicated in the literature. When first seen and for thirty-six hours afterward, the condition of 2 of the patients was deceptive in that they did not look severely shocked or as ill as one might expect patients with perforation of the intestines to be. The facies of moderate well-being was completely unlike that in the common abdominal catastrophe. The rigidity was much more pronounced than had previously been seen in perforation of the intestinal tract. The authors had seen it equalled only once and that in a man with rupturing, dissecting aneurysm of the abdominal aorta.

It is probable that these patients would have done better with immediate surgical intervention. However, the results of laparotomy in 1 case make it clear that perforation results from gangrene which follows gross bruising and that many patches of bruising do not lead to gangrene and perforation, so that too early laparotomy might defeat its purpose if perforation were to occur subsequently. The findings, however, point to the necessity of exploration of the abdomen, and the authors would prefer to explore even in the early hours and find nothing more than bruising of the viscera, rather than let a perforation go untreated. HAROLD C. OCHSNER, M.D.

Wakeley, C. P. G.: Blast Injuries. *Glasgow M. J.*, 1943, 139: 91.

Wakeley reviews his experiences with blast injuries in the present war. The blast wave in air is made up of three components: (1) the positive pressure wave; (2) the negative or suction wave; and (3) mass movement. The effect of an explosion in water is not the same as in air because the primary pressure wave is not followed by a wave of mass movement nor is there a negative wave. The effects of blast waves, nevertheless, in air or water produce similar injuries.

The most common lesion in these injuries is in the lungs and it has been amply proved that blast has a

far greater detrimental effect on tissues containing air than on any other.

The clinical manifestations usually consist of the signs of shock with dyspnea, cough, cyanosis, pain in the chest, and hemoptysis. The physical signs found are usually diminished movement of the diaphragm and fullness in the lower part of the chest; lobar pneumonia may develop rapidly. X-ray study discloses basal opacities with heavy mottling scattered over the lung fields. At autopsy the most constant findings are petechial hemorrhages in the trachea and bronchi, with multiple hemorrhagic areas in the lungs and massive hilar contusions.

Treatment consists of allaying the patient's fears, giving oxygen (with a B.L.B. or helmet type of mask), venesection, the administration of morphine, and strict prohibition of first aid and artificial respiration. If other injuries are present requiring anesthesia for correction, an inhalation anesthetic should be avoided. Proper rehabilitation is required before these patients can be returned to civilian or military life.

Abdominal injuries occur more frequently from blast in water. The intestinal tract suffers more frequently than the solid viscera. The clinical manifestations vary according to the distance from the explosion, the nature of the explosion, and the position of the man in the water. Nearly all patients experience a sharp slap on the abdominal wall which may temporarily paralyze both legs. The most common conditions found are retroperitoneal and subserous hemorrhages. The gut lesions vary from intramural hemorrhages to laceration of the intestinal wall. The large intestine suffers more than the stomach or small intestine, and the liver is often severely involved.

The treatment of perforation may necessitate excision, but many cases can be safely handled by conservative suture. J. M. MORA, M.D.

Findlay, G. M., and Martin, N. H.: Jaundice Following Yellow-Fever Immunization; Transmission by Intranasal Instillation. *Lancet*, Lond., 1943, 244: 678.

In 1937 the authors drew attention to the occurrence of jaundice following yellow-fever immunization, cases of which they had been investigating since 1934. In subsequent special memoranda they brought forward evidence to show that the jaundice following yellow-fever immunization had nothing whatever to do with the yellow-fever virus as such, and stated that they believed it was probably due to some agent in the human serum used in the preparation of the vaccine.

It was considered possible that the icterogenic agent had multiplied, together with the virus of yellow-fever, in a serum Tyrode culture medium containing minced chicken embryo, and it was certain that the agent had passed through a Seitz filter pad.

After the technique of preparing the vaccine was altered by holding the donors' serum for one month to establish the fact that the donor was in perfect health, and the serum was inactivated for thirty minutes at 56°C., it was found no further cases of postinoculation jaundice occurred in many thousands of immunizations. Two outbreaks of jaundice since 1937 occurred in South America, in 1939 and 1940, possibly due to the insufficient inactivation of the serum. Recently, among American Army personnel inoculated with yellow-fever vaccine, 28,585 persons developed jaundice and 62 of them have died (J. Am. M. Ass., 1942).

In jaundice following inoculation for yellow-fever the authors note two differences from ordinary infective hepatitis: namely, the length of the incubation period, and the fact that cases of postinoculation jaundice have not given rise to epidemics of infective hepatitis. The prolonged incubation period, sometimes up to one-hundred and twenty days, is not inconsistent with a virus etiology.

In order to show that an infective icterogenic agent is present in the nasopharynx of patients suffering from jaundice following yellow-fever vaccine infection, numerous experiments have been made. All attempts to transmit the disease to the usual laboratory animals have failed. It was, therefore, determined to investigate the possibility of transmission to human volunteers.

Jaundice was produced in 3 human volunteers by instilling into their nostrils nasal washings in salt solution from 3 patients in the early icteric stages of jaundice following yellow-fever inoculation. The jaundice was produced after incubation periods of twenty-eight, thirty, and fifty days. The symptoms varied in severity, but were those of infective hepatitis. The volunteers had been immunized to yellow-fever some eight months previously from a batch of vaccine which had not produced jaundice in any of those so inoculated. They lived in a semiclosed area free from jaundice cases as far as could be ascertained.

Besides jaundice following the injection of yellow-fever vaccine prepared from human serum, and also following the injection of measles immune serum, jaundice following transfusion with human blood and jaundice following the injection of mumps convalescent plasma have now been recognized. Thus the agent responsible for the jaundice is obviously present in serum as well as in nasal washings. The presence of an infective icterogenic agent in nasal washings is suggestive of a virus rather than of a hypothetical toxin. Further investigations are in progress.

JOHN E. KIRKPATRICK, M.D.

Young, H. H., Haines, J. S., and Prince, C. L.: Orthostatic Albuminuria. The Importance of Its Recognition by Medical Examining Boards. *Mil. Surgeon*, 1943, 92: 353.

The case histories of 4 patients rejected by the medical examining boards of either the army or the navy because of the presence of albumin in the urine are reported in detail. In each of these cases it was established by careful clinical and laboratory tests that the albuminuria was orthostatic in character and that no kidney lesion was present. As a result

of these reports, the examining boards who previously had rejected these men accepted them for admission, 1 to the West Point Military Academy, 1 to the army, and 2 to the navy. In the presentation of these 4 cases the clinical and laboratory tests which have been found valuable are discussed, the diagnostic value of placing the patient in an exaggerated lordotic position being emphasized.

Sixty-seven cases diagnosed as orthostatic albuminuria have been studied from the records of the Johns Hopkins Hospital. Three of these were shown to be cases of definite nephritis and were excluded from this analysis. In the remaining 64 cases no evidence of nephritis has developed with the passage of time, and repeated examinations in some of them have shown the urine to be free from albumin at various periods after admission to the hospital. These studies show definitely that orthostatic albuminuria is a harmless condition which eventually disappears, generally early in adult life.

Before a diagnosis of orthostatic albuminuria is made, the following criteria should be met: (1) no past history of renal disease; (2) normal blood chemistry, nonprotein nitrogen, blood urea, total protein, and albumin-globulin ratio; (3) normal kidney function (phthalein, urea clearance, and dilution and concentration tests); (4) no white blood cells, red blood cells or casts in the urine, except intermittently and in small numbers; (5) no elevation of the blood pressure; (6) negative plain roentgenograms and intravenous urograms; and (7) absence of albumin in the urine secreted and voided when the individual is in the recumbent position.

It is evident that among the young men of this country there are a considerable number of cases of orthostatic albuminuria and that many have been rejected by medical examining boards because of the presence of albumin in the urine. With the more comprehensive tests, which we have outlined, many of these men probably could have been shown to be fit for service. It would seem desirable for draft boards to reopen the records of these cases and subject patients who have been rejected because of albuminuria to more tests. J. M. MORA, M.D.

Ungley, C. C.: The Treatment of Immersion Foot by Dry Cooling. *Lancet*, Lond., 1943, 244: 681.

Webster *et al.* (1942) treated cases of immersion foot in the hyperemic stage by dry cooling. Cooling was achieved in one of three ways: (a) dry cooling—ice bags were placed around the feet long enough to reduce the skin temperature by 6° C.; (b) evaporative cooling—cold water was sprayed over the feet by a nebulizer; and (c) low temperature air cooling—cold air in the room was allowed to circulate about the exposed feet. This latter method was improved by Green (1942) who described a "therapeutic refrigerator" but never chanced to use it. It consisted of a box arranged to circulate air over dry ice and about the feet. The author found after trial of the "refrigerator" that it would maintain a satisfactory temperature if properly insulated; however, because of the discomfort of restricting leg motion as in a stock, other methods were tried.

A modified evaporative cooling method was put into effect by the simple play of the breeze from an electric fan on the soles of the feet without the addition of water vapor to the air stream.

In a detailed report of 2 cases of immersion foot, one mild and the other moderately severe, Webster's finding that cooling of the hot feet relieves pain and tingling is demonstrated. The speed and distance of the fan were adjusted to maintain skin temperatures between 23°–26° C., determined by a thermocouple attached to the skin of the great toe; cooling to less than 21° C. gave rise to discomfort.

Webster *et al.* refer to severe cases in which removal of ice-bags was followed by marked increase of edema, extravasation of blood, and spread of gangrene. In the 2 cases reported here, edema had subsided before treatment was commenced; no exudation or necrosis followed interruption of the cooling, and return of high skin temperatures was not necessarily associated with immediate return of pain and tingling. Intermittent alternation of fan cooling and exposure to cool room air can be used under these circumstances.

The mode of action of fan cooling requires further investigation. Webster suggests that, by reducing metabolic requirements, it overcomes a relative anoxia existing in the hot tissues.

JOHN E. KIRKPATRICK, M.D.

Logie, N. J.: The Treatment of Burns at Tobruk. *Lancet*, Lond., 1943, 244: 609.

Logie presents experiences and impressions gained from the treatment of over 300 burns of all degrees of severity, while he was serving in Tobruk before it fell in 1942. Second-degree burns generally do well regardless of the type of treatment, provided that recognized surgical principles are adhered to. Third-degree burns are the real problem. Usually, differentiation between deep second and third-degree burns is not possible on first inspection. Efficient local treatment depends entirely on whether anesthesia can be administered. If no anesthesia is available, no efficient cleansing is possible and therefore no tanning compound should be used, for it only shuts in potential sepsis and makes the subsequent cleansing more difficult. Under such circumstances only first aid is possible, and Logie advises covering of the burnt area and protection of the blisters against injury and rupture with an ample sterile dressing. He prefers a sterile soft paraffin dressing over sulfathiazole powder.

A burn dressing in desert warfare should (1) be easy and quick of application, yet efficient; (2) give relief from pain and shock; (3) give protection against infection, dust, dirt, and trauma both in the hospital and in transit; (4) reduce the nursing care to a minimum; and (5) give assurance that when the patient and his burn have reached the base, both are in such state that further treatment, e.g., skin grafting, is not delayed unduly.

The author then evaluates various methods. He states that the dye method is unsatisfactory because drying is slow, repeated applications are necessary and, therefore, time-consuming, protection is poor, and infections occur frequently.

Tanning with 10 per cent silver nitrate and 10 per cent tannic acid worked best. This mixture dried quickly and easily; the tan was firm and had good protective qualities. The edges of the burn were painted daily with triple dye to prevent infection from creeping in. The method had certain limitations, viz., (1) it could not be applied to the face as the tan was too rigid and facial deformities were feared; (2) its use was avoided on circular lesions of the hands and fingers; (3) the tan tended to crack in the region of the joints and infection followed; splintage minimized this; (4) in body burns, parts exposed to constant pressure broke down and became infected; (5) once the tan was applied it was irremovable until it separated by the normal process of healing (this prevented early access to the burn for other treatments, such as hydrotherapy and skin grafting); (6) silver nitrate, being caustic, may convert second-degree into third degree burns; and (7) in complete circular lesions of the limbs there was danger of a "tourniquet effect" from the rigid tan and associated swelling of the limb.

The combination of sulfanilamide, paraffin and plaster was very satisfactory for limb burns, since it met all of the requirements. It did not fulfill expectations as regards helping to keep the burn free from hemolytic streptococci, even when prophylactic sulfanilamide was given by mouth. However, it has certain disadvantages: (1) the dressings are retained on the body with difficulty; (2) the exudate soaks the dressings and often the plaster, sometimes necessitating changes in two or three days; (3) there is always the potential danger of attaining dangerous blood-level concentrations from rapid absorption of the sulfanilamide from the burned surface. For this reason the less soluble and wider-ranged sulfathiazole would be preferred. The author recommends powdering with sulfathiazole and covering the burns after surgical cleansing with soft paraffin gauze.

EDWIN J. PULASKI, M.D.

Henderson, J. M.: The Relation of Sunlight to Desert Sores. *Brit. M. J.*, 1943, 1: 657.

In the series of cases here described the desert sores took the form of annular subepithelial whitlows occurring on the exposed surfaces of the limbs, and varying in size from 1 to 3 cm. To lend certainty to the diagnosis of what is undoubtedly a distinct clinical entity, only patients presenting six or more of these lesions were included in the group of 50 cases studied.

THE RELATION OF TRAUMA TO THE OCCURRENCE OF SORES

It is of considerable interest that 21 of the 50 patients were unable to account for the presence of the sores. They stated that they did not believe them to be due to injury. In the 29 other cases the majority thought that one or more sores were due to knocks or cuts, but the men were able to point out a number of sores which they did not believe had been caused by trauma. In 6 cases only was the statement made that injury had occurred at the site of every sore.

COINCIDENT FACIAL IMPETIGO

In 12 of the 50 cases impetiginous lesions were present on the face, often in the neighborhood of the mouth or ears. Thus, facial impetigo was observed in 1 case of every 4. This must be regarded as an unduly high incidence, and leads one to believe that its occurrence is in some way related to the typical subepithelial whitlows of the limbs. In 4 cases impetiginous sores were present on the neck.

THE RELATION OF THE SEASONS

Case-taking disclosed that only 1 patient in the series claimed that he suffered from sores all the year round.

Of those who had not experienced a previous summer in the desert, 1 had been in the desert for three months, 4 for six months, 24 for eight months, and 1 for eleven months. It is significant that in these cases the sores made their appearance chiefly in either June or July rather than at times related to the duration of the individual's stay in the desert. Only 1 of the patients spending their first summer in the Western Desert stated that he had previously suffered from desert sore.

It would thus appear that, allowing a seasonal incidence of desert sore, the factor most likely to be of importance is sunlight. Bearing this in mind, it was decided to estimate, so far as was possible, the part played by the individual resistance to the sun's rays.

THE RELATION OF ORIENTATION OF THE INDIVIDUAL TO SUNLIGHT

The differentiation of individuals results in two main groups. In the first, marked pigmentation of the skin occurs, and reddening and scaling are absent. In the second, in the extreme cases, the exposed skin is unable to adapt itself, and erythematization is the chief reaction to exposure, attended in many instances by dryness of the skin and repeated scaling. While many persons fall between these two groups, it seemed from clinical study that it was among the second group that cases of desert sores were most frequently found. As might be expected, the majority of those in the first group also showed the natural evidences of pigment-forming powers; they were most often brown-haired with brown or gray eyes. On the other hand, lack of pigment-forming power was most common among the fair-haired with blue eyes.

THE DISTRIBUTION OF THE SORES

The sores occurred on the surface skin which was exposed. Subepithelial whitlows, however, were seen only on the hands, fingers, arms, and legs. They did not occur on the face and neck, although it has

been pointed out that impetiginous lesions were not uncommon in these areas.

The hands were most commonly affected. Three factors may be of significance in this respect: (a) the hands are most liable to suffer trauma; (b) the surface hair is less well developed than on the forearms; and (c) in the very fair-haired the skin on the back of the hands often becomes red and glazed as a result of frequent and prolonged exposures to sunlight.

NOTES ON PREVENTIVE TREATMENT

The following measures have been adopted so far as is possible:

1. Patients have been instructed to wear their sleeves down. When the sleeves showed signs of having shrunk the men were told to exchange their shirts for ones with longer sleeves. Protection of the forearm is thus provided against trauma, the effects of sunlight, and insect bites. If the sleeves are long enough some degree of protection is also afforded to the hands.

2. For the same reasons the susceptible were also advised to wear long trousers.

3. The difficulty of adequately protecting the hands and fingers is apparent. A supply of vanishing cream or of oil, preferably containing a small amount of antiseptic, might be helpful. It would have to be applied to the hands each morning after washing, as washing would destroy the protective film. Only the susceptible members of a unit, usually well known to the medical officer by reason of many visits to the M. I. room, would need to be so supplied.

JOHN A. LOEF, M.D.

Editorial: Surgery in the Desert. *J. R. Army M. Corps*, 1943, 80: 266.

In 1931 when a small party of officers and men from the British Garrison in Cairo managed to cross the Desert with motor vehicles and reached the historic oasis of Siwa, eventually returning to Cairo without loss of men or material, the undertaking was hailed, particularly by the Army authorities in Egypt, as a not inconsiderable achievement. Men who knew the Desert appreciated the difficulties. It would be safe to say that it gave the General Staff cause for thought in that the Libyan Desert—the western barrier to Egypt, previously regarded as an impassable barrier to an army—had been proved to be capable of negotiation.

Roughly ten years later a force of British and Colonial troops, barely two divisions strong, chased the enemy out of Egypt and followed him into his own territory even as far as Benghazi. By then we had become so accustomed to hearing about Desert warfare and its peculiar problems that we began to take things for granted, without stopping to remind ourselves of the enormous amount of organization and planning that had been necessary to bring about such an amazing change; a change characterized not so much by the fact that we had actually ejected from Egypt an enemy considerably superior in numbers and had captured many of his men and much of his equipment, but because it demonstrated that even a modern army can maneuver and contain itself in such an abomination of desolation as the North African Desert.

By now all officers in the Corps know what changes had to be made in arrangements to meet the medical needs of this Desert warfare, in which opposing forces move rapidly and maneuver like fleets at sea. The Corps is proud of these achievements and appreciative of the fact that they have been acknowledged in the Honor conferred on the Director of Medical Services, M.E.F.

We know, too, by this time what were the changes necessary to make the "Surgical Service" in the Middle East Force capable of taking its proper place in the medical organization. We also know that the Hartgill Committee at the W.O. made much use of the reports received from the experienced "Desert Rats" in the M.E., as well as that from less active fronts, in planning and devising our latest field medical units and organization. The new Field Surgical Units, based on those hastily scraped together in the M.E., are already proving their worth in North Africa.

Outstanding changes in surgical policy and outlook in relation to the treatment of various types of wounds have already been broadcast through the medium of A.M.D. Bulletins, War Office Memoranda, etc. It is necessary to remain alert and to react to any new situation with the least possible delay. At all times we must be prepared to abandon any method which has not stood up to the test of practical application in any particular theater of war, or to accept fresh developments which, after due appraisal, seem likely to be of general value.

It is obvious that although we have improved our surgical work in a large number of ways, there are still pitfalls to be avoided; for instance, pressure sores around the ankles or dorsum of the foot, where a temporary clove-hitch extension for a fracture has been left *in situ* beyond the A.D.S. Adhesive extension strapping is provided at every A.D.S. Again, limbs continue to arrive at Base or L. of C. units encased in plaster-of-Paris, or tightly bandaged and with the circulation embarrassed. Medical officers tend to forget how inevitable in a wounded limb is the onset of posttraumatic edema. Unless an encased limb can be kept under personal observation for forty-eight hours the cast should always be split before the patient is evacuated.

In spite of repeated warnings the optimism of some surgeons still induces them to attempt primary suture and then to pass the case on to someone else. There is ample evidence that immediate (primary) suture is not justified in spite of local or oral administration of sulfonamide unless the surgeon is able to retain the case under his own personal supervision and is prepared to treat the consequences! Delayed primary suture may be justified, but this again should be a matter for decision only after careful consideration and personal observation of the case. Failure of immediate or delayed suture will

prolong convalescence, even if it does nothing worse. A skilful and experienced surgeon in a well-appointed operating theater may manage virtually to sterilize a relatively fresh wound, using a scalpel alone, but under conditions in the Desert that is well-nigh impossible and it is wrong to assume that the local application of sulfonamide can make up for imperfections in the surgical procedure. It is known that sulfonamide alone will not prevent the growth of wound contaminants and that it has virtually no action on the dread anaerobes. Bacteriologists think that it has not materially changed the flora of wounds since the last war; on the other hand, experienced clinical observers appear to think that it has certainly altered wound intoxication, and both agree that the establishment of infection has been reduced in wounds of certain localities (head, chest, and abdomen). By some, the tie-on "sulfonamide label," originally suggested by Logie, Mitchell, and Buttle, and recently simplified by Boyd, is regarded as an outstanding advance in that it renders dosage almost foolproof.

It has been found necessary to issue a warning against excessive local application of sulfanilamide powder to extensive third-degree burns, because serious toxic effects have been reported. On the recommendation of the M.R.C. War Wounds Committee field trials with a mixture of sulfathiazole and proflavine, in powder form, are to take place. "S.P. Powder" (99 parts sulfathiazole and 1 part proflavine) can be used both in prophylaxis and treatment of wound infection in the same way as sulfonamide is now used. The limitations imposed by Desert conditions has led to a modification in the treatment of infected wounds. Those over twelve to twenty-four hours old have been treated in the Middle East by a limited operation described as "wound trimming." In effect, this simply means the removal of foreign matter and dead tissues and the relief of tension by incisions planned to facilitate drainage.

Surgeons at the Base complain that medical officers in the forward areas are still prone to forget how important it is to write brief and legible notes on Field Medical Cards. The whole course of the case may depend on the accuracy of the information so conveyed. Lives and limbs have been saved by an underlined note made by a Field Ambulance M.O. directing attention to some complication which may be anticipated and should be guarded against.

It is good to be able to report that the figures for recovery of abdominal wounds from the El Alamein battle, when these become available, may be expected to show a recovery rate which is a considerable improvement on any previously reported results. The Consultant Surgeon, Middle East Force, considers that this improvement may be attributed to the following:

Excellent resuscitation arrangements and good selection of cases. Early operation to control hemorrhage and to suture damaged hollow viscera. The performance of temporary colostomy either (a) above a damaged or sutured loop of large gut, or (b) by exteriorization of the damaged segment or segments. Sulfadiazine, introduced in the peritoneal cavity in neighborhood of the injury before closure. The immediate establishment of suction drainage of the stomach. Nothing by mouth. Intravenous fluid drip continued for several days. Holding the cases in F.D.S.'s or C.C.S.'s until fit to travel.

Closure of sucking chest wounds by suture temporarily allays the distress of an open pneumothorax, but unless it is preceded by a complete wound excision it will suffer the fate of all sutured war wounds; two days later it will be heavily infected, the sutures must be removed, and the sucking wound is reestablished, now complicated by a pyopneumothorax and a cellulitis of the chest wall. It is now advised that sucking wounds (after trimming, if the patient's condition allows it) should be closed with a sterile pad, folded to fit the hole and held in position by a few silkworm-gut sutures tied over it. This method is safe and mechanically satisfactory and the opening will either close spontaneously under a series of pads, or can be repaired by secondary suture in a Chest Center when the primary reaction to injury is past.

Face wounds, too, are harmed rather than helped by early surgery. Excision will not avert infection, and suture—even loose approximation—besides inviting cellulitis leaves ugly stitch scars. These injuries, after first-aid fixation of jaw fragments by the dental officer and surgeon, should be dusted with sulfanilamide powder, covered with vaseline dressing, and left widely open.

Head injuries travel well and the tendency is to do as little conservative surgery as possible in the forward areas and transfer the case as soon as possible to a Center.

Administrative medical officers have ceased to regard the posting of a surgeon to a particular location as constituting an adequate or complete solution to the local surgical requirements. A surgeon cannot perform his proper function unless he can work with his own team at a properly constituted Surgical Center, where his worst cases can be resuscitated before they come to the theater and nursed after operation. The selection of cases, both in relation to the necessity for, and priority of, operation is best left to the Resuscitation Officer, in consultation with an officer of surgical experience. The development of the Resuscitation Service is one of the outstanding features of this war. What appears to be required now is a little more judgment as to when plasma and fluids will suffice and when whole blood is required; alternatively, when whole blood is not necessary. There has been a tendency to date to use this life-giving fluid too liberally or even wastefully. The provision of even the minimum essential fresh whole blood for a force is a major problem.

Such, then, are some of the useful lessons we have learned from this Desert surgery. Treatment is carried out by keen and tough young men under circumstances which, even under optimum Desert conditions, would be regarded by the average experienced surgeon as extremely difficult. At times,

indeed, climate, dust storms, shortage of water, and black-out have made such conditions appalling. Some of the surgeons have even worked through a period of temporary captivity—few have not worked under fire. Their zeal and the knowledge that they were doing a fine and really worth while job has sustained them. Their reward has been the recovery of many men who would have succumbed but for their efforts, and the admiration and thanks of those whose pleasure it has been to direct and assist them.

(ORIGINAL ARTICLE)

Gallagher, J. L.: A New Multi-Purpose War Dressing. *Mil. Surgeon*, 1943, 92: 609.

The first aider should be taught and thoroughly practiced in a very simple, practical method of caring for each situation that is likely to confront him. Specifically, these situations are the control of hemorrhage, optimal wound dressing, splinting of fractures, and the prevention and treatment of shock.

In the past, bleeding from the extremities was quickly controlled with the tourniquet, but this means of control is hazardous to the limb, the wound, and the life of the patient. With the exception of the tourniquet, there has been no logical means, at the scene of injury, of safely controlling hemorrhage from the extremities, and practically none from other portions of the body. The tourniquet, when used by other than well trained doctors, subjects the patient to the pain and dangers of constriction. It is often applied too loosely, or the fastener slips enough to cause pump action, so that the arterial blood is very little retarded and the returning venous blood is entirely stopped, which causes the blood of the body to be lost at a much greater rate than it would be without the tourniquet. If it is applied too tightly, pressure necrosis may occur.

Fig. 1. The medium-sized dressing. End of bandage is stitched to dressing pad. Mattress suture anchors bandage to form handle for easy aseptic removal from container and application to wound. Pull string of single bow knot is left long for releasing bandage for application.

The author devised a dressing simulating a sea sponge, which is sufficiently firm to press the injured blood vessels against the hard bone tissues lying underneath, with enough force to cause their collapse. The material in this sponge-like dressing, however, has enough resiliency to give with the natural force within the injured vessels and permits the circulation to continue through uninjured vessels to tissues distal to the wound and into the tissues of the wound. It is not essential that the hemorrhage be stopped entirely, but that a severe hemorrhage be converted into a minor ooze, from which the natural process of clotting will ensue. The pressure exerted by the dressing tends to obliterate spaces and crevices of the wound, and thus bring the tissues in closer contact with the defense elements of the blood stream.

It is known that edema in the wound area is evidence of impaired circulation, and that cells surrounded by the fluid of edema are largely deprived of the beneficial function of the blood. A proper resilient pressure dressing practically eliminates edema formation in the wound area. A large soft pressure dressing also serves to splint the wound and tends to prevent mechanical spreading of infection and to alleviate pain. Since all the material composing the dressing described is absorbent, it serves as a drain to the wound.

Unlike the tourniquet, the dressing has a safety factory in that it may remain as originally applied without adjustments or change for a number of days, if necessary, whereas the tourniquet requires constant supervision.

The method of preparing the multi-purpose war dressing is carefully described.

SAMUEL KAHN, M.D.

Hayden, R.: Activities of the Naval Hospital at Pearl Harbor Following the Japanese Air Raid of December 7, 1941. Comments on the Care of Battle Casualties. *Am. J. Surg.*, 1943, 60: 161.

The treatment of battle casualties means the treatment of mass casualties. Because of the great number of patients requiring prompt treatment, all that is possible at first is advanced first aid: the administration of morphine, control of hemorrhage, prevention of infection, and treatment of shock. Upon admission, all patients were given ½ gr. of morphine sulfate hypodermically, and 1,500 units of tetanus antitoxin, alone or combined with anti-gas gangrene serum.

All patients suffered from shock in varying degrees. Most deaths occurred within twenty-four hours, and were due to acute or delayed shock. The treatment of shock takes precedence over all other treatment except control of hemorrhage. Both for the pain, and as first treatment for shock, morphine was given, local heat was applied, and blood plasma, saline and glucose solution, or normal saline solution was administered intravenously. The shock must be controlled before any other treatment is instituted.

With extensive burns, however, a first spraying or other local application may be done simultaneously with the treatment for shock.

A great variety of surgical cases of all kinds were admitted. The wounds were grossly cleaned in the dressing room; accessible metal fragments and badly torn skin and muscle were removed; hemorrhage was controlled; sulfanilamide powder was shaken generously into the wound; and an occlusive dressing of sterile plain or vaseline gauze was applied. Following this preliminary treatment, patients were operated on when time permitted. At operation, wounds were thoroughly débrided, and the entire wound was again thoroughly dusted with sulfanilamide powder. Sulfathiazole was unsatisfactory because it formed a coating which caused secretions to be retained, and local infections did not seem to be as well combatted. Wounds of the extremities were not closed unless very superficial, or unless more than three days had elapsed since the injury. These wounds should not be closed at the time of the first dressing.

More than half of the fractures were compound. These were treated as were other large wounds, the fractures were reduced, and a plaster cast was applied, skeletal traction being incorporated in the cast whenever necessary. Severe wounds of the soft parts demand splinting just as fractures do. The use of sulfonamides has revolutionized the treatment of wounds; together with the use of blood plasma, it has reduced the death rate to less than 1 per cent, as against a rate of 7 per cent in the first World War. The use of sulfanilamide by mouth was found to be a necessary adjunct to the local use of the drug in severe cases.

Most of the anesthesia was obtained by the drop ether method. This lends itself to this type of surgery, and may be given by those with little training.

The majority of head wounds are usually compound depressed fractures. The scalp wound may be quite small, and may be missed on examination. Operation should be done as soon as practicable, preferably not later than six hours after injury. The most important part of the operation is a thorough cleansing and débridement of the wound tract in the brain. Damaged brain tissue and blood clots are removed by suction, and all foreign material is carefully picked or gently washed out. The tract is then irrigated with sterile saline solution. The bleeding is controlled, and the tract filled with sulfanilamide powder. The missile should be left alone if it is small and inaccessible. The wound in the dura must be closed. If it cannot be drawn together, it should be patched with a piece of periosteum or fascia lata.

Chest wounds permit air to rush in and out of the pleural cavity, cause shock, and often result in death; they must be promptly closed if the patient is to live. They may be closed with a pad of moist gauze. A large square of rubber tissue is preferable, however, since it permits air, blood, and exudates to flow out, but prevents air from entering the chest. If these are not available, the wound must be quickly closed with anything available—the patient's shirt or an ordinary thread and needle. Hemorrhage from the lungs usually ceases spontaneously. Arterial hemorrhage has to be controlled by ligation.

Abdominal wounds require early operation, or fatal peritonitis will develop. If an intra-abdominal injury is suspected, an exploratory laparotomy should be done. The wound of entrance should be excised, and packed with sulfanilamide. The abdomen should be entered through a separate incision. The entire abdomen should be examined carefully and systematically. Bleeding should be controlled and multiple bowel perforations closed. Resection should not be done unless the intestinal blood supply is inadequate. About 10 gm. of sulfanilamide should be scattered through the peritoneal cavity, and the wound closed without drainage.

Flash burns are caused by the very temporary but terrific heat produced by the flash of flame during the explosion of bombs and torpedoes. Parts of the body covered by clothing of any kind were not burned. Burns were given some local treatment—some type of tanning—as rapidly as possible. Morphine was administered. Shock treatment was started as quickly as possible. In cases of severe burns, plasma should always be given in divided doses. During the first twenty-four hours, 1,000 cc. should be given if 10 per cent of the body surface is burned, and 2,000 cc. if 20 per cent is burned. Plasma should always be given intravenously. In some cases, triethyldiazine (a 2½ per cent solution of sulfadiazine in 8 per cent triethanolamine) was used. This solution relieves pain, increases resistance to infection, prevents loss of fluids, and forms a semitranslucent, pliable film, through which the condition of the burned surface can be followed. In the treatment of burns, sulfanilamide is the drug of choice for local or parenteral therapy, and sulfadiazine for oral therapy.

Blast injury or concussion of the lung was treated symptomatically. Morphine or codeine was given for restlessness and cough, and oxygen for respiratory difficulty. Fluids were forced and bed rest was compulsory. SAMUEL KAHN, M.D.

Ungley, C. C.: Vitamin C Intakes in a Small Ship. *Lancet*, Lond., 1943, 244: 578.

As a sequel to an inquiry into the causation of sore and bleeding gums in naval personnel, the present investigation sought to obtain accurate information as to vitamin C intake on small ships. Foods eaten by 11 seamen serving in a trawler-mine-sweeper were weighed by an individual method and their vitamin C content measured.

The average daily intake of ascorbic acid was about 16 mgm. in the first week which increased to 30 mgm. in the second week. The average daily intake per 10 stone body-weight varied from 15.1 to 27.7 mgm., the average for 11 men being 22.6 mgm. (0.35 mgm. per kgm).

The low intake in the first week was attributed chiefly to failure to obtain sufficient of the fresh vegetables which were available in the district.

Plasma ascorbic levels obtained at the end of the survey were low, but the ratings showed no clinical evidence of nutritional deficiency. The gums varied from normal to slightly subnormal and were never scorbutic. HOWARD A. MCKNIGHT, M.D.

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Sachs, A. E., and Goldberg, S. L.: Foreskin Isografts. *Am. J. Surg.*, 1943, 60: 255.

The authors believe that the use of skin from newborn and premature infants is an important factor in the success of isoplastic skin transplants. The nuclei of the cells of the skin of the infants contain a higher percentage of mitotic figures than do those of the skin of adults, which suggests that the growth potentialities are greater. In the authors' experience the blood groups of the donor did not influence the survival of the grafts. It was also their experience that the blood grouping of about 25 per cent of the infant donors could not be accurately determined.

The survival of transplanted skin in this series of cases varied between 65 and 75 per cent. Even in the cases in which the transplants failed to survive the presence of the skin seemed to act as a stimulant to the patient's own epithelium and more rapid epithelization was the result.

The authors know of no method of determining the length of survival of transplanted skin, but in their experience this skin, once having taken, did not disappear in several weeks as Bettman, Greeley, Coller, and others reported. Some grafts could be distinctly recognized eight months later. It is impossible to say how long they survive, or if they are ultimately replaced. One of the cases followed up over a period of two years showed no loss of grafted skin with the exception of two tiny areas. The others which were followed for shorter periods showed practically no loss of skin.

Several occurrences in the course of the work have given added weight to the observation that the grafts remain longer than other reports indicate. In 1 case a graft had not been placed on firmly and in healing a small papillalike crease of skin protruded. This remained without changing and finally was removed three and a half months after the graft had been applied. In 1 instance of transplantation of skin from a premature cadaver the lanugo hairs persisted for several weeks. In a colored patient a very small piece of white skin was transplanted to an inconspicuous area. This white skin became attached and remained.

The authors are emphatically not advocating this type of graft to replace other methods now in use, for obvious reasons. The end-results from the cosmetic viewpoint are definitely not as good as with split-thickness autogenous grafts. However, they do believe that in certain instances this graft is of great value as a life-saving measure. The range of its use is increased by the fact that it may be used on the ambulant patient, and on surfaces that are not entirely surgically clean. The production of another open wound at the donor site and the use of anesthesia are obviated by this method.

J. M. MORA M.D.

Large, O. P.: A Comparison of Tissue Reactions from New Sutures. *Am. J. Surg.*, 1943, 60: 415.

Animal experiments show that alloy-steel metallic sutures give the minimal of reaction with maximum of tensile strength in the wound. Cotton, silk (plain or waxed), plastigut, nylon, and catgut show increasing degrees of reactions in the order mentioned. Plastigut produces excess fibrosis, while nylon stimulates epithelization, or proliferation of squamous cells in the tissues through which the suture passes. Intestinal anastomoses made with alloy-steel-wire interrupted seroserous sutures gave practically no reaction and were free of adhesions at the end of two weeks. J. M. MORA, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Weiss, C.: The Pathogenicity of Bacteroides Melaninogenicus and Its Importance in Surgical Infections. *Surgery*, 1943, 13: 683.

Bacteroides melaninogenicum is a small, gram-negative, anaerobic, nonsporulating black pigment-producing rod which has been isolated from a wide variety of lesions, notably those in the mouth and tonsils, from pulmonary abscesses, the gastrointestinal tract when infected and from the uterus and blood stream in puerperal fever. Immunologically distinct strains on the basis of specific proteins have been established. Virulence of the organisms for animals and man varies greatly. The organism is an "opportunist" which is capable of producing disease only when given a favorable opportunity to enter the tissues or when natural resistance to infection is low. The organisms grow in enriched media after four or five days of incubation under strict anaerobic conditions and produce a putrid foul odor. Together with anaerobic streptococcus putrificus it is responsible for the unpleasant odor of some types of pus.

Weiss studied the pathogenicity of the bacillus melanonigenicum and its role in surgical infections. Data are presented which indicate the isolation of the organism with other aerobic and anaerobic bacteria from 45 surgical cases representing various infected wounds of the soft tissues, lesions of the pleura and peritoneum, as well as of the gastrointestinal, respiratory, and urinary tracts. He recovered the organisms also at autopsy from the heart's blood, the peritoneum, and visceral organs.

The fact that the organism possesses a fibrinolysin, which permits it to dissolve human blood fibrinogen, is regarded by some as evidence of invasiveness or pathogenicity. When mice are inoculated subcutaneously with freshly grown cultures, edema, inflammation, and dermonecrosis result. In rabbits extensive lesions can be produced by intracutaneous injection. The sites become hot, greenish black,

indurated, and swollen to about 3 times normal size, and there is an outpouring of much turbid foul-smelling exudate. Death may ensue. Previous damage of the tissue by staphylococcus toxin enhances the dermonecrotic properties of the organisms. Pathogenicity and invasiveness are enhanced if mucin is used as a menstruum for suspending the bacteria. Smears show a capsulelike substance surrounding the bacilli.

The author believes the bacillus melaninogenicum should be regarded as an "opportunist" pathogen which must find conditions suitable for invasion and multiplication. EDWIN J. PULASKI, M.D.

ANESTHESIA

Adams, R. C., Lundy, J. S., and Seldon, T. H.: Continuous Caudal Anesthesia or Analgesia. A Consideration of the Technique, Various Uses, and Some Possible Dangers. *J. Am. M. Ass.*, 1943, 122: 152.

Although these authors expressed the opinion that the principles of this new method of anesthesia are sound and that its use will continue to expand, they pointed out that the technique may be difficult and may be accompanied by certain potential dangers and complications.

After a preliminary trial of the method of Hingson and Edwards, the authors devised an alternative technique with the idea of preventing possible breakage of the needle. It also was thought that the use of flexible equipment might permit greater freedom of movement by the patient, particularly during a long labor.

After the skin over the site of injection has been anesthetized, a 20-gauge intravenous needle 1½ in. long is attached to the syringe containing the anesthetic solution and is inserted through the sacrococcygeal ligament at an angle of 45 degrees. After the needle has pierced the sacrococcygeal ligament and rests lightly on the anterior wall of the sacrum, 5 cc. of a 1.5 per cent solution of metycaine is injected. This needle then is withdrawn and a 13-gauge Love-Barker needle, with its stilet in place and with the bevel directed upward, is inserted at an angle of about 45 degrees and introduced through the sacrococcygeal ligament. When the needle touches the anterior wall of the sacral canal, its bevel is turned downward and its hub depressed, after which it is advanced upward cautiously along the midline of the caudal canal. In order to prevent injury of the venous plexus lining the canal, the needle should not scrape the bone of either the anterior or posterior wall of the canal. The point of the needle is advanced to about the level of the third sacral foramen but never as high as the second foramen.

The stilet of the needle then is removed and a No. 5 ureteral catheter (woven silk or, preferably, nylon) is passed through the needle and into the caudal canal. It is advanced so that its tip will rest at about the level of the third sacral foramen. The catheter then is grasped distal to the needle to maintain it in the proper position while the 13-gauge needle is withdrawn over it by combined pull and rotation. The catheter is left in place in the caudal canal. The patency of the catheter should be checked before it is inserted. After the needle has been withdrawn, 5 cc. of a 1.5 per cent solution of metycaine is injected through the catheter into the caudal canal to check the patency of the lumen of the catheter and also to test for any untoward reaction to the anesthetic.

It is important that the external end of the catheter be kept sterile. When the catheter is in place in the caudal canal, a 22-gauge Luer hypodermic needle, the bevel of which has been cut off square, is inserted into the catheter and is held there with a small piece of adhesive tape. A sterile Luer cap then is applied to the hub of this needle; this will block any backflow of solution and will keep the end of the needle sterile.

Before the adhesive tape is applied, the skin about the site of the catheter is painted with a solution of mastic in benzene and a small sterile piece of sponge rubber or rubber dam is slipped over the catheter and is pressed firmly against the skin, which has been painted with the adhesive preparation. This forms a tight seal around the catheter and its point of exit and helps to prevent soiling or contamination by secretions.

Several pieces of waterproof adhesive tape are applied to the catheter at its exit from the skin, both to hold it in position and to form a seal around the exit of the catheter. The remaining portion of the catheter is curved laterally and strapped to the skin of the flank with adhesive tape, its end being left in an accessible position for repeated injections.

There are certain dangers and precautions which apply to both single dose and continuous caudal anesthesia. Both methods have certain advantages and disadvantages.

Bunim, L. A.: The Effect of Local Anesthesia by Means of Pudendal Nerve Block with Novocain on Cervical Dystocia Occurring Late in the First Stage of Labor. *Am. J. Obst.*, 1943, 45: 805.

Thirty-eight patients were treated for cervical dystocia late in the first stage of labor by pudendal nerve block with novocain. Thirty-one of the patients were primiparas and 7 were multiparas. There were no maternal deaths among the 38 cases. There was 1 stillbirth, due to intracranial injury following the application of forceps, in a case of cephalopelvic disproportion. Generally about five or ten minutes after the anesthetic is injected, one notices a relaxation of the perineum. In another ten minutes the spasticity of the cervix disappears and dilatations progress satisfactorily if the uterine contractions continue. If there is uterine inertia, small repeated doses of pituitary extract (2 min.) will initiate further progress.

This procedure failed in 1 case. The average duration of labor for the 38 cases was thirty-one and nine-

tenths hours, and the average arrest of progress lasted six and three-tenths hours.

In this series, maternal exhaustion with a spastic resistant rim of cervix remaining at a standstill, for an average of six and three-tenths hours, was found to be the most frequent indication for intervention. Most cases required outlet forceps to complete delivery. Labor was terminated in every case after the use of local block anesthesia, and the average length of time from injection to the birth of the child was twenty-one and one-half minutes.

EDWARD L. CORNELL, M.D.

Rochford, J. D., and Broadbent, B. T.: Ethyl-Chloride Analgesia. *Brit. M. J.*, 1943, 1: 664.

Ninety soldiers were subjected to analgesia with ethyl chloride for minor surgical procedures, the majority being dental extractions. Many of the subjects were anesthetic-resistant.

Lincoln's technique of oral breathing was used, the drug being sprayed on a piece of gauze placed between the teeth, off and on for forty-five seconds. The amount of the drug used varied between 4 and 9 cc., the average being about 6 cc.

Total analgesia lasted from sixty seconds to one-hundred and twenty seconds. Recovery was as rapid as with nitrous oxide and there were no after-effects.

MARY KARP, M.D.

Batterman, R. C., and Himmelsbach, C. K.: Demerol—a New Synthetic Analgesic. A Review of Its Present Status and Comparison with Morphine. *J. Am. M. Ass.*, 1943, 122: 222.

Demerol is a new synthetic analgesic which is of importance because of the present threat to our opium supply and because of the increased need for opium in time of war. It represents one of a large group of piperidine compounds possessing spasmolytic properties. It has mild atropinelike and definite morphinelike properties.

One of demerol's three main actions is analgesic. When administered orally, an elevation of the peripheral pain threshold results in fifteen minutes, reaches a peak at the end of an hour, and subsides in about six hours. The duration of analgesia is about three hours. When administered parenterally, demerol is at least as effective as morphine in producing clinical analgesia. In postoperative patients it is a more suitable drug than morphine or its derivatives.

The second important action of demerol is its general spasmolytic effect. Segmental contractions and the tone of the intestine are diminished or abolished while propulsive action is unaltered. Clinically, there is often rapid and dramatic relief of colicky pain of the intestines, kidneys, or ureters. (The drug has little value in the treatment of diarrhea.)

The effect on the uterus is still negligible. The acute spasmodic effect on the bronchial musculature provides basis for its beneficial effects in patients with bronchial asthma.

The third action of demerol is sedation. This usually occurs with the larger parenteral doses, resulting in sleep from which the subject can be easily aroused. Patients note no after-reactions or mental confusions on awakening. The opiate was found to be in every way as satisfactory a preanesthetic agent as morphine, when used in a series of 338 surgical patients requiring a general or spinal anesthetic. It appears to have very little if any sedative effect on cough.

Other pharmacological studies reveal no effect on the size of the pupil or ocular accommodation in man. Corneal anesthesia may occur. The basal metabolic rate is unaltered. Drying of the mouth, flushing of the face, and perspiration are common findings. Nausea and vomiting are noted less frequently than with morphine. The rapid dissipation of the drug tends to offset undesirable cumulative effects such as respiratory depression and urinary retention. Prolonged use of the drug may lead to the development of habituation. However, it appears to possess a lesser liability than morphine of physical dependence. In order to avoid this danger, amounts greater than 150 mgm. every three hours should not be given.

MARY KARP, M.D.

Randolph, H. S., and Kober, L. R.: The Use of Pentothal-Sodium Anesthesia in Thoracic Surgery. *J. Am. M. Ass.*, 1943, 121: 1215.

A comparison of available anesthetic agents for use in thoracic surgery is made.

Ether shows 6.1 per cent pulmonary complications even when used by the closed-system method. Procaine-hydrochloride infiltration and nerve block is attended with considerable shock and pain, and increased wound infection. Spinal anesthesia seems to reduce the margin of safety. Nitrous oxide, cyclopropane, and ethylene are now most widely used in thoracic surgery.

The authors favor the use of pentothal sodium without procaine for thoracic surgery. Premedication consists of 1½ gr. (0.1 gm.) of phenobarbital the night before surgery and from ⅛ to ⅙ gr. of morphine sulfate preoperatively. From 2 to 4 cc. of 5 per cent pentothal sodium are administered; this is followed by a pause of sixty seconds; then from 8 to 10 cc. are injected before the operation is begun and from .25 to 1 cc. per minute is added during the remainder of the operation. Oxygen is given by nasal catheter if cyanosis appears.

One hundred and twenty-three thorocoplasties were performed on 53 patients. The average duration of the operations was forty-nine minutes; the longest one took one hundred minutes, the shortest, twenty minutes. The average amount of pentothal sodium used was 24 cc.

Postoperative nausea was less than that noted following inhalational anesthesias. Awakening from this anesthetic was pleasant and more like awakening from a night's sleep than from an artificially imposed anesthesia.

There was an apparently reduced incidence of postoperative spread. Atelectasis occurred in 2 cases.

MARY KARP, M.D.

Dorman, D. B.: Avertin Anesthesia in Gynecology. Report on a Series of Cases. *Am. J. Surg.*, 1943, 60: 403.

Willstatter and Duisberg first described the synthesis of tribromethyl alcohol in 1923. Butzengeiger and Eichholtz used it clinically in Germany. Its use in the United States has been extensive since then.

Avertin causes a slight increase in the respiratory rate and a decrease in the respiratory volume. The pulse rate is slightly increased and the blood pressure usually falls, occasionally markedly. The effect on the liver and kidneys is negligible unless these organs show previous damage, and this may preclude the use of this agent.

The author reports 1,800 cases in which tribromethyl alcohol was used. Three grains of phenobarbital were given at bed time, ¼ gr. of morphine and 1/150 gr. of atropine sulfate were administered one hour before surgery, and the avertin was given from twenty to thirty minutes before surgery. The usual dose of avertin was 100 mgm. per kilogram of body weight, although a maximum of 7 cc. of avertin was given. The group excluded women over fifty-five years of age who had been scheduled for plastic operations alone. These patients were given morphine-sulfate. With the exception of these exclusions and of patients in severe shock, the cases were not selected.

At the beginning of the operation in the case of abdominal section, it was often necessary to administer a dilute mixture of nitrous oxide for a few minutes while the incision was made and the packing was placed in position. In vaginal plastic operations, supplementary anesthesia was less often required. Coramine or caffeine were used as stimulants for marked postoperative drops in the blood pressure. Postoperative vomiting and gagging were almost completely eliminated. The commonest urinary findings did not persist usually beyond the third day, and by the tenth day the kidneys apparently again functioned normal.

In a series of 98 cases studied in detail from the postoperative standpoint, the 1 death, caused by a pulmonary embolus on the tenth day, was discussed in detail; but in the total series of 1,800 cases, 21 deaths occurred. These were tabulated and discussed. The conclusion reached was that avertin could not possibly be held responsible for 17 of them. In the remaining 4, avertin may have been a contributing factor. However, in none of these was a complete autopsy granted to confirm the cause of death. All 4 of the patients died of renal complications between the second and tenth postoperative days.

Contraindications include renal damage, the presence of shock with anemia, liver disease, colitis, and advanced pulmonary disease. Complications include respiratory depression and shock.

Avertin reduces the fear of coming to the operating room and smooths postoperative convalescence. The author concludes that avertin more nearly approaches the ideal anesthetic than any other drug which has been employed in his clinic for a gynecological patient. MARY KARP, M.D.

Haugen, F. P.: Hypertension. Management of the Anesthesia Period. *Current Res. Anesth.*, 1943, 22: 152.

From the standpoint of management of the anesthetizing period, it is the hypertensive patient with involvement of the heart, coronary vessels, or cerebral vessels, who presents the increased anesthetic risk. Extremes of blood-pressure changes are not well tolerated by the hypertensive patient. Coronary thrombosis, cerebral thrombosis, or congestive heart failure may result from a period of marked hypotension, and the development of these conditions may not be manifest until the anesthesia period is well passed. When a patient is conscious, breathlessness will limit his efforts, but during anesthesia these warnings cannot serve their purpose.

The premedication of the hypertensive patient should be on the heavy side, the purpose being to allay fear and apprehension, and reduce the amount of blood-pressure increase and excitement to a minimum during induction.

The induction period should be slipped through with the least amount of excitement, with the avoidance of anoxia and carbon-dioxide accumulation. Pentothal sodium, in a 2½ per cent solution, given immediately before induction, reduces the number of excitements in a nitrous-oxide-ether sequence, or a cyclopropane sequence.

During maintenance and the recovery period of the anesthetic, hypoxemia and carbon-dioxide excess should be avoided. Occasionally a patient will be sensitive to even small increases in inspired carbon dioxide, and in the toxic individual with hypertensive cardiovascular disease the rise in blood pressure, which usually takes place, may be most significant. In such patients pentothal sodium, cautiously given intravenously, may complement the anesthetic, or sodium nitrite (1½ to 3 gr.) injected intravenously, may cause a transient but substantial decrease in the blood pressure. The same result will follow the inhalation of amyl nitrite. Any degree of obstruction of the airway must be avoided, as even partial obstruction may cause hypoxemia.

Every effort should be made to prevent a marked fall in the blood pressure during anesthesia. Surgical shock, acute blood loss, spinal analgesia, and prolonged or deep general anesthesia are a few of the causative factors producing hypotension. The use of vasopressor drugs before and during the administration of a spinal anesthetic may avert a fall in the blood pressure. Pressure by packs or retractors on the celiac plexus in upper abdominal surgery may produce hypotension, and atropine sulfate (1/150 gr.) may be of value in depressing an overactive celiac-plexus reflex, or the removal of packs or retractors may help. Sudden changes in position may cause a sudden drop in the blood pressure. While blood, plasma, or saline infusion should form the basis of treatment for hypotension which is due to surgical shock or blood loss, care must be taken not to overload a weakened myocardium. Epinephrine should be avoided during cyclopropane anesthesia,

neosynephrin being preferred. The hypotension following prolonged cyclopropane administration can be avoided by the addition of ether to the anesthetic mixture. MARY KARP, M.D.

SURGICAL INSTRUMENTS AND APPARATUS

Venable, C. S., and Stuck, W. G.: Clinical Uses of Vitallium. *Ann. Surg.*, 1943, 117: 772.

With the introduction of the alloy vitallium into bone surgery, a metal was found that was inert in the body fluids and, consequently, free of any unfavorable tissue reactions. No metal is suitable in the body if it is subject to corrosive change due to chemical or electrolytic action in the tissue fluids. Electrolytic action accompanies unfavorable tissue reaction; the elimination of electrolytic action, through the use of a metal which resists chemical effects of the body fluids, eliminates the usual damage.

After experience with hundreds of cases, it is now established that vitallium is the most inert alloy currently used in surgery. In traumatic surgery, bolts, screws, and plates of vitallium have been found to be the most useful in repairing fractures which could not be maintained in position by wires, kangaroo tendon, beef-bone screws, or other less stable materials. Fractures of long bones, intercondylar fractures into joints, and grossly displaced fractures when replaced and anchored by vitallium plates and screws have been found to heal more rapidly and with less disability than when treated by the appliance of other metals. The use of vitallium nails and screws in the treatment of fractures of the hip has eliminated irritation of the tissues, and has markedly diminished the need for a secondary operation of removal. Following excision of the head of the radius, a vitallium radial cap has been found to facilitate motion and prevent excessive new bone formation. In fractures of the jaws, in acromioclavicular separations, and for the reattachment of small fracture fragments, various types of vitallium nails and screws have been used with successful results.

The most spectacular use of vitallium appliances to replace lost tissue was for a metal head and neck of the femur, which was inserted after the entire upper end of the femur was resected for a malignant tumor. The patient was thereby given a strong, stable, painless hip on which he walked for several years.

For defects of the skull, vitallium plates serve as dependable, comfortable protectors of the adjacent soft tissues, without the usual headaches that follow other replacements. A vitallium support has been used to restore the normal contour of the nose during plastic operations for congenital lues, or after osteomyelitis. After enucleation of the eye, some implant is needed to preserve the skin folds and provide a foundation for the artificial eye. The vitallium replacement is more comfortable and secure than any other appliance.

When the testicle is removed, it is desirable to replace the defect to overcome abnormal psychological reactions. Implants of vitallium have been found to be satisfactory.

In the arthroplasty of joints, in the treatment of strictures of the bile ducts, in the repairing or replacing of portions of the ureter, as a colostomy plug, and in many other conditions, vitallium appliances have been found to be of great value.

SAMUEL KAHN, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Rowe, S. N., and Jacox, H. W.: Experiences with Roentgen Irradiation following Operation on Brain Tumors. *Am. J. Roentg.*, 1943, 49: 480.

The authors have been impressed by the good palliative results often obtained in seemingly hopeless cases of brain tumor by operation and subsequent irradiation, and have been prompted thereby to review their experiences in this field. They have collected a group of cases of known cerebral gliomas, and a group with strong presumptive evidence of such a lesion, with follow-up observations for a period of at least one year of the patients who are living. Several illustrative cases are cited in detail.

In the discussion of these cases, they state that in evaluating results of the combined surgical and irradiation treatment of such tumors on the basis of the clinical course, it is difficult to separate the effects of operation from the effects of irradiation, or vice versa. Although a fairly accurate standard of life expectancy for a given type of glioma has been set up, it is practically impossible to predict the natural course of the disease for a given patient, in whom the duration, extent, and location of the lesion cannot be sharply defined. Nevertheless, they believe that in some cases it is possible to demonstrate clear-cut evidence of clinical improvement due to irradiation, and that if reasonable caution is exercised, this method offers a satisfactory means of evaluating the therapy. In several patients the response to operation was so slight, and improvement following roentgen irradiation so definite, that there could be little question of the effectiveness of the latter. In addition, a number of patients showed a definite response to irradiation at a stage when their gain from previous surgical or roentgen therapy was rapidly waning.

The following conclusions are drawn:

1. The best results of combined surgical and roentgen therapy seem to be obtained when most of the tumor can be removed and intensive irradiation given without dangerously increasing the intracranial pressure.

2. There are frequent exceptions to the usually accepted rules as to the radiosensitivity of various types of glioma.

3. In brain tumors which are inaccessible surgically, decompression and irradiation may occasionally produce prolonged benefit.

4. Approximately half the patients in this series died within one year regardless of surgical or roentgen treatment. However, at the present time it is impossible to determine before treatment is begun which patients will fall into this hopeless group, and which may be definitely benefited by treatment.

5. We believe that one is rarely justified in refusing operation or roentgen therapy, or both, even to the patient who presumably has an advanced, highly malignant, or deeply situated brain tumor.

A. HARTUNG, M.D.

Taylor, H. K., and McGovern, T.: Evaluation of Angiocardiography. *J. Am. M. Ass.*, 1943, 121: 1270.

Two hundred and fifteen angiocardiographies were done on 100 patients whose ages varied from twelve to ninety-three years. With the Robb-Steinberg technique, from 30 to 50 cc. of a 70 per cent solution was injected intravenously. Diodrast sensitivity tests were made by injecting 0.2 cc. diodrast intradermally. There seemed to be no correlation between the degree of sensitivity and the reaction experienced when from 30 to 55 cc. were injected intravenously. Reactions to the intravenous injection of diodrast were minimal and transitory. The blood pressure dropped as much as 80 mm. of mercury in some cases but was normal again within five minutes. Bodies of the patients became warm and there was flushing of the head and neck. Salivation, nausea, and coughing were also present. Some patients developed itching and urticarial rashes which were relieved by epinephrine.

The circulation time was determined before the diodrast injection. In most cases, two injections of diodrast were sufficient for satisfactory visualization of the heart. Two erect posteroanterior and two oblique views were taken at a distance of six feet.

The normal angiocardiograms and their variations as seen in posteroanterior, right and left anteroposterior oblique, and lateral views are described in detail.

Angiocardiograms facilitate the differential diagnosis between mediastinal and vascular tumors. They also facilitate the diagnosis of right heart enlargements, aneurysms, and cardiovascular anomalies.

MAURICE D. SACHS, M.D.

Baylin G. J., and Lambeth, S. S.: The Roentgen Diagnosis of Placenta Previa. *Radiology*, 1943, 40: 497.

Snow, in 1934, suggested the use of soft-tissue roentgenography for the demonstration of the position of the placenta. In 1939, after reviewing the contributions of several other investigators, he showed conclusively that the method is simple, practical, and reliable.

Three roentgenograms are made in late pregnancy—the conventional anteroposterior and lateral roentgenograms plus a soft-tissue lateral roentgenogram. Snow injected 200 cc. of air into the bladder for better contrast but the authors did not find this necessary. Instead they use a plastic filter to prevent overpenetration of the anterior abdominal soft tissues. The soft-tissue roentgenogram is taken with low kilovoltage and a relatively short exposure time.

The placenta, which occupies 20 to 30 per cent of the endometrial surface, is readily identified as a thickened shadow fused with the uterine wall in most of the soft-tissue lateral roentgenograms.

The authors were able to make a correct diagnosis of placenta previa in 14 of 16 cases. They could even differentiate between marginal and complete placenta previa, a fact of considerable importance from the clinical standpoint. It is the authors' contention that the method deserves more widespread use in obstetrical practice than is afforded at the present time. T. LEUCUTIA, M.D.

McWhirter, R.: The Value of Postoperative Radiotherapy in Carcinoma of the Breast. *Edinburgh M. J.*, 1943, 50: 193.

This is the Honyman Gillespie lecture delivered in the Royal Infirmary of Edinburgh on March 4, 1943.

The following method of staging, suggested by Ralston Paterson of Manchester, was adopted:

Stage I. The growth is confined to the breast. Involvement of the skin directly over and in continuity with the tumor does not affect staging, provided that the area involved is small in relation to the size of the breast.

Stage II. The same as Stage I, but there are palpable mobile glands in the axilla.

Stage III. The growth extends beyond the corpus mammae as shown by:

(a) Invasion or fixation of the skin over an area which is large in relation to the size of the breast.

(b) Fixation of the tumor to the underlying muscle. Axillary glands may or may not be palpable, but if glands are present they must be mobile.

Stage IV. The growth has extended beyond the breast area as shown by:

(a) Fixation or matting of the axillary glands, which indicates extension outside of the capsule.

(b) Complete fixation of the tumor to the chest wall.

(c) Metastases in the supraclavicular glands.

(d) Metastases in the skin wide of tumor.

(e) Metastases in the opposite breast.

(f) Distant metastases in the bones, liver, lung.

Paget's disease of the nipple is accepted as primary duct carcinoma and regarded as Stage I unless palpable glands are present.

The series studied included a total of 1,879 cases observed during the period from 1930 to 1942, of which 30 per cent were in Stage I, 17 per cent in Stage II, 20 per cent in Stage III, and 21 per cent in Stage IV; 11 per cent were recurrent carcinomas, and 1 per cent were not classified.

The primary purpose of this article is to demonstrate the effect of postoperative radiotherapy and, therefore, appropriate comparisons with surgical procedures are made. The opinion is expressed that the three-year symptom-free rate is as good a guide as the five-year survival rate and it permits more rapid evaluation of the results.

In the surgical group were placed only those cases in which the operation was radical. The radiotherapy group was subdivided: in certain cases postoperative irradiation was undertaken following radical surgery, while in the remainder less extensive operations, such as simple mastectomy and even local removal of the tumor from the breast, were performed, but a full course of radiation therapy was given subsequently. The author considered as a full course the administration of at least 3,500 roentgens in three weeks (and in the majority of cases 4,500 roentgens in four weeks) to the chest wall and to the whole length of the chain of lymph nodes from the axilla to the supraclavicular region on the affected side. Cases in Stage IV, for obvious reasons, were not compared.

The recurrence rate in the "treatable area" and the symptom-free rate were analyzed year by year for the first three years for both the surgical and the combined group. The composite results are shown in the following table:

TABLE I.—RECURRENCE IN THE "TREATABLE AREA" AND SYMPTOM-FREE CASES AT THREE YEARS

	Total Recurrence Per cent	Symptom-Free Cases Per cent
Stage I		
Radical surgery	23.4	54
Surgery plus radiotherapy	5.4	76
Difference	18.0	22
Stage II		
Radical surgery	34.9	28
Surgery plus radiotherapy	16.1	60
Difference	18.8	32
Stage III		
Radical surgery	34.7	21
Surgery plus radiotherapy	14.5	44
Difference	20.2	23

It is of special interest that a comparison of the cases in which radical mastectomy and postoperative radiotherapy were used with those in which the surgical procedure was less extensive but the postoperative radiotherapy was carried out with full doses revealed practically no difference in the final results. This fact is illustrated in Table II.

TABLE II. COMPARISON BETWEEN RADICAL SURGERY ALONE, RADICAL SURGERY PLUS POSTOPERATIVE RADIOTHERAPY AND SIMPLE MASTECTOMY PLUS POSTOPERATIVE RADIOTHERAPY. SYMPTOM-FREE CASES AT THE END OF ONE YEAR

	Radical Surgery	Radical Surgery plus Radiotherapy	Simple Mastectomy plus Radiotherapy
Stage I			
Total Cases	165	109	93
Symptom-Free one year	124(75%)	94(86%)	86(92%)
Stage II			
Total Cases	84	85	54
Symptom-Free one year	52(62%)	72(85%)	43(80%)
Stage III			
Total Cases	107	62	48
Symptom-Free one year	50(47%)	52(84%)	41(85%)

The necessity for early diagnosis and treatment is amply emphasized.

On the basis of these statistical results, the author arrives at the conclusion that postoperative radiotherapy may be relied upon to destroy the malignant cells left behind, even when the disease has spread to the axillary lymph nodes. Moreover, radical dissection of the axilla does not seem to appear necessary when the postoperative irradiation is thorough, simple mastectomy leading to equally good results. However, the author stresses that such procedure is still on trial and, therefore, it should not be generally adopted by other centers until further confirmative results are available. T. LEUCUTIA, M.D.

Schmitz, H. E.: Further Study of Supervoltage X-Ray Therapy in Carcinoma of the Cervix. *Radiology*, 1943, 40: 458.

Seventy-two cases of primary, previously untreated carcinomas of the cervix were seen on the Gynecologic Service of the Mercy Hospital Institute from May, 1933 to January, 1938. It was found that in clinical groups I and II, carcinoma of the cervix was arrested by supervoltage x-ray therapy in 75 per cent of the cases, but the greatest number of cases fell in clinical groups III and IV, of which only 26 per cent could be salvaged. The total five-year survival rate of 37.5 per cent was lower than that previously reported, but about the same as that given by Kamperman for a group of cases treated similarly. Two case reports are given.

HAROLD C. OCHSNER, M.D.

McMilan, K. D.: Gas Gangrene. An Analysis of 416 Collected Cases Threatened by Roentgen Therapy, with 13 New Cases. *West. J. Surg.*, 1943, 51: 187.

It is the purpose of this article to present a collective review of reported cases of gas gangrene and report 13 cases observed personally. Incidence and diagnosis are discussed briefly and attention is called to the diagnostic value of roentgen examination. Prophylactic administration of adequate doses of tetanus and gas-gangrene antitoxin and roentgen irradiation play an important part in the preliminary treatment of cases liable to develop gas gangrene.

Active treatment should consist of: (1) 100 roentgen units of x-ray given over involved areas as soon as the diagnosis is made or strongly suspected, and repeated twice daily for three days, or until the infection is brought under control; (2) local débridement; and (3) administration of therapeutic amounts of the antiserum if the infection is more than twelve hours old, or does not respond to the previous treatment.

Amputation for gas gangrene, per se, should not be resorted to.

Four hundred and fifty-four cases have been collected, in 416 of which x-ray therapy was used. In the 416 cases there were 62 deaths, a mortality of 14.9 per cent, as compared with Millar's mortality of 49.7 per cent in 607 collected cases, which did not receive x-ray therapy.

The author's 13 cases are reported in detail; all of them received roentgen therapy as part of their treatment. Ten of the patients recovered.

A. HARTUNG, M.D.

Barnes, W. A., and Furth, O. B.: Studies on the Indirect Effect of Roentgen Rays in Single and Parabiotic Mice. *Am. J. Roentg.*, 1943, 49: 662.

Since the original work of Heineke in 1904 on the effect of irradiation upon normal and malignant tissues, a vast literature has grown on this subject. Three theories have crystallized from the multitude of opinions expressed in connection with the mechanism of the action of roentgen rays on living tissue; it is believed that (1) the roentgen rays have a direct effect on the cells; (2) an indirect effect, local or general; and (3) a combined direct and indirect effect.

The authors investigated the direct and indirect effects by irradiating single and parabiotic animals and they now report the results by paying special attention to the indirect effect of irradiation on the blood and blood-forming tissues of parabiotic mice.

Inbred mice of the same stock, of the same age, and, in many cases, litter mates, were used. Two of 4 mice in each group were joined in parabiosis by the method of Sauerbruch as modified by Bunster and Meyer with changes described elsewhere. From two to four weeks after operation all 4 mice were tied to a wire frame and 1 of the parabiotic and 1 of the simple control mice were irradiated, while the other parabion and single mouse were completely protected with from 3 to 6 mm. of lead and other adequate measures.

The physical factors of irradiation were: 200 kv., 15 ma., 3 mm. of aluminum, 25 cm., 320 roentgens per minute. In some instances other factors were used.

Blood counts were taken from the tail vein at two or three-day intervals several times before and from two to five days after irradiation. The mice died or were killed at intervals from one to fifty days following exposure. If one parabion died, its twin and control mice were immediately killed. For the study of the indirect effect sections were taken from organs most distant from the site of irradiation.

The authors describe in detail the changes observed in exposed and nonexposed bone marrow of single mice irradiated with 800, 2,000, and 6,000 roentgens, and of rabbits irradiated with 1,500 roentgens. It was noted that the larger the dose the earlier was the decrease of hematopoetic cells in the directly irradiated marrow. There was no conspicuous destructive effect in the nonexposed marrow, although hyperemia and a slight increase of polymorphonuclear leucocytes often occurred. In a like manner, the lymph nodes directly exposed were extensively damaged but only pyknosis or fragmentation of the nuclei was seen in the nonexposed lymph nodes. It is the authors' contention that these indirect changes represent a nonspecific effect similar to that observed following burns, or exposure to heat, cold, and the electric current. To confirm this they have induced

burns in a series of mice under nembutal anesthesia and found that the changes of the bone marrow and lymph nodes could not be distinguished from those observed in these organs following indirect irradiation.

In the parabiotic series only mice were used and they were irradiated with 800, 3,200, and 6,000 roentgens. The changes occurring in the blood-forming organs of a parabion directly exposed were similar but quantitatively less than those occurring in a single mouse similarly irradiated. The nonexposed parabion showed no changes with 800 and 3,000 roentgens and only pyknosis and fragmentation of the nuclei of the lymphoid cells occurred seven hours after its twin received 6,000 roentgens. Within three days there was complete recovery in the nonexposed animal whereas the exposed twin showed persistent damage consisting of aplasia of the bone marrow and marked decrease of the cellular elements of the spleen and lymph nodes.

In another series of experiments the authors studied extensively the effect of varying doses of roentgen rays on the number of leucocytes in the blood of single and parabiotic mice. Thirty-seven single mice were exposed over the entire body to doses of from 100 to 1,000 roentgens, and leucocyte counts were made one, three, six and ten days after irradiation, and in many animals several times thereafter. In the parabiotic mice, 12 sets and 24 additional single controls were used. The doses here varied from 400 to 1,000 roentgens. Numerous graphs are included in the text to show the results obtained.

Leucopenia occurred in a shielded parabion after exposure of its twin to from 800 to 1,000 roentgens. There are at least two possible explanations of this effect. It may be that because of the rapid fall in the number of leucocytes in the exposed twin, leucocytes migrated from the nonexposed to the exposed parabion as a compensatory function, or it is possible that the blood of the exposed parabion became so altered that when it passed to the nonexposed parabion it depressed the leucocyte level of the latter. Leucopenia in an exposed parabion is less severe than in an exposed single animal, probably because of migration of the leucocytes from the nonexposed twin.

The conclusion is reached that roentgen irradiation produces slight indirect changes in unexposed hematopoetic and lymphoid tissues of rodents, because of nonspecific factors carried from the directly exposed tissues by way of the circulatory system. Parabiosis diminishes this deleterious effect, which indicates that the indirect effect of roentgen rays is best explained on the basis of humoral factors.

T. Leucutia, M.D.

Luedin, M.: When is X-ray Therapy of Cancer Indicated and What can be Expected from It? (Wann ist die Roentgentherapie des Krebses indiziert und was ist von ihr zu erwarten?). *Schweiz. med. Wschr.*, 1942, 72: 1237.

The author, whose practice is limited to radiation therapy, is of the opinion that except in cases of skin cancer, surgery is indicated in each operable carcinoma. Irradiation is indicated in tumors in which a surgical procedure is not advisable on account of the location, the relationship of the lesion to the adjoining organs, or the danger of disfigurement. All inoperable tumors should be subjected to irradiation.

The most recent method of irradiation, introduced by Chaoul, is based on the use of specially constructed tubes which shorten the distance between the focus and the irradiated area. The employment of soft rays and a short focus distance allows very large doses to be applied to a superficial tumor, while the blood vessels and connective tissue are well protected. The cosmetic effects of this method are excellent.

According to extensive statistics, permanent cures may be expected in 12 per cent of all cancer cases in which x-ray therapy is employed for curative purposes. Of course, palliation therapy is not considered here. Postoperative irradiation, especially after amputation of the breast, improves the prognosis as to permanency of the cure. The author recommends irradiation after each surgical procedure for cancer.

Experience with preoperative treatment is still too limited to permit a definite opinion.

Bone metastases after cancer of the breast are particularly suitable for x-ray therapy. In place of a defect created by the tumor a new bone forms, the calcium contents are increased, and the bone becomes firm. Palliation of cancer of the bladder gives encouraging results: the tumor shrinks, annoying hemorrhages from the bladder stop, and the patients may be able to continue working for many months or even years. Therapeutic effects of irradiation are not good in pulmonary carcinoma: 22 patients were treated by the author and the average survival period was only eight months.

Joseph K. Narat, M.D.

Howes, W. E., and Levin, B.: Lymphosarcoma. A Statistical Study and Evaluation of Treatment. *Radiology*, 1943, 40: 565.

The authors review briefly the generally recognized data relative to lymphosarcoma, and discuss the classification and pathology of the various types of lesions. They present 47 proved cases which were admitted to the Brooklyn Cancer Institute for statistical review. These are tabulated as to classification according to pathology, year of admission, the end-result and average monthly survival, the most probable site of origin and survivals, and the total duration and type of therapy.

Special consideration is given to the various lesions involving the neck; the groin, abdomen, and retroperitoneum; the tonsils, antrum, and nasopharynx; the mediastinum; the axilla; bone; and the rectum. Illustrative case histories are summarized with detailed accounts of therapy, illustrations, photomicrographs, and roentgenograms of some cases.

Treatment is discussed at length. When localized, lymphosarcoma may be eradicated by surgery or irradiation. When generalized, however, the possi-

bility of cure becomes negligible, and irradiation is the only logical modality of treatment. The radiation technique used by the authors is described both in connection with localized lesions and generalized involvement. Four of 36 patients with generalized lymphosarcoma have survived from two to six years. In a further effort to correlate treatment with results, the case histories of these 4 patients are summarized, the radiation therapy in each instance is analyzed, and the prognosis estimated. Thirteen of the entire group of 47 are living after from two to six years; 9 have no evidence of residual tumor and appear to have had their disease eradicated by surgery, irradiation, or both.

The following conclusions are drawn:

When lymphosarcoma has metastasized, treatment should include not only the obvious areas of superficial involvement, but also the mediastinum and retroperitoneal regions. While lymphosarcoma is most radiosensitive, a sterilizing dose should be administered. In the authors' opinion, this approximates 3,000 roentgens to the tumor within three weeks. A. HARTUNG, M.D.

Trump, J. G., and Cloud, R. W.: The Production and Characteristics of 3,000 Kilovolt Roentgen Rays. *Am. J. Roentg.*, 1943, 49: 531.

A generator which produces constant voltages up to 4,000 kv. is described. The physical properties of roentgen rays and their progressive changes at the elevated voltages were studied. As the voltage was increased the maximum ionization below the surface increased. This phenomenon has been called "subcutaneous effect" and was hardly apparent at 200 kv., where the ionization intensity remained practically constant for the first 5 mm. below the surface. At 1,000 kv. the increase in the "subcutaneous effect" was considerable. This accounts for the decreased skin erythema. With the increase in kilovoltage the "subcutaneous effect" increased and the surface intensity decreased. (Surface intensity is the summation of primary and secondary [backscatter] electrons.) Depth-dose measurements with increased voltages were calibrated. At 10 cm. depth there was an increase in the depth dose from 32 per cent at 200 kv. to 57 per cent at 4,000 kv. Increase in treatment distance increased the depth dose according to the inverse square law. Increase in filtration increased the depth dose and accentuated the "subcutaneous effect." All measurements were made with a specially constructed ionization chamber.

MAURICE D. SACHS, M.D.

Dresser, R.: Preliminary Clinical Observations on the Use of 3 Million-Volt Roentgen Rays. *Am. J. Roentg.*, 1943, 49: 536.

Roentgen volts produced at 3 megavolts have the same physical properties as those of the gamma ray of radium. However, a greater depth dose and treatment at longer distances may be obtained by supervoltage irradiation. The following factors were used in the treatment of cancer patients: 3 million volts constant potential, 100 cm. F.S.D., 10 mm. of lead plus 5 mm. of copper filtration, 0.5 mm., and 10 by 10 cm. or 15 by 15 cm. field.

The patients treated to date have been those with carcinomas of the pelvic region and these were treated in groups with a sufficient time interval allowed between each group to enable a careful study of all symptoms and reactions. The first group received 400 roentgens daily to the anterior pelvis; total dose of 1,200 roentgens. The subcutaneous roentgen intensity was 90 roentgens per minute. Observation of this group for one month following therapy revealed no unusual reactions. The second group received a total of 2000 roentgens with no untoward results. The third group received 2,400 roentgens. These patients had diarrhea but there was no erythema or epilation. The fourth group received 2,800 roentgens. These patients had diarrhea and bladder irritation. However, in no case was there any skin reaction or loss of pubic hair. All the patients tolerated the radiation rather well, with the exception of 1 with an extensive carcinoma of the bladder. This patient, incidentally, responded no better when treated at 200 kv.

At 3,000 kv. 2,800 roentgens is the suberythema dose. It is to be expected that larger dosages will be tolerated, especially in other parts of the body where the underlying structures are not as vulnerable as the intestines and bladder. These series treated to date have been followed for a five-month period and the tumor dose is less than that given at 200 kv. However, the supervoltage therapy was given within a period of one week, whereas the 200 kv. therapy is generally given in a period of about three weeks. The immediate reactions of the intestines and bladder and their duration with both forms of therapy are about the same. There have been no sequelae up to the present time. MAURICE D. SACHS, M.D.

RADIUM

Nolan, J. F., and Arneson, A. N.: An Instrument for Inserting Multiple Capsules of Radium within the Uterus in the Treatment of Corpus Cancer. *Am. J. Roentg.*, 1943, 49: 504.

In 1938 the authors introduced at the Barnard Free Skin and Cancer Hospital and on the teaching service of the Barnes Hospital a new technique of radium application for the treatment of cancer of the corpus uteri. This is a preliminary report on its use.

The technique simulates the method employed by Heyman at the Radiumhemmet of Stockholm. Briefly, it is as follows:

Multiple radium sources of various sizes and strengths are placed within the uterine cavity by means of a uterine dressing forceps. Small strips of gauze are inserted between the capsules to immobilize them and also to establish distance around the stronger sources. At the conclusion of the application roentgenograms are made to check on the proper position and distribution of the capsules.

The longer brass capsules contain 12.5 mgm. of radium and the shorter ones 6.0 mgm. in removable platinum cells. By suitably arranging several such capsules together, it is possible to obtain approximately the same radium strength per centimeter length. If the cervix is also involved, larger capsules are used in that region, up to 25 mgm. in strength. The total filter of the capsules amounts to an equivalent of 2.00 mm. of brass.

The instrument used for the introduction of the capsules is described in detail and illustrated.

From 1938 to 1941, inclusive, a total of 69 patients was treated, 24 with tandems and 45 with multiple sources. In the tandem cases a total dose of 4,000 mgm.-hrs. was given. In the multiple-source cases, the dose was determined by the length of the uterine cavity, averaging between 4,800 and 6,500 mgm.-hrs. So far as possible the radium treatment was followed by hysterectomy. It was found in the specimens removed that necrosis was always greater with the tandem applications, whereas in the multiple-source cases the distribution of the radium effect was more uniform.

The authors recommend that in planning preoperative treatment both roentgen rays and radium be used to obtain the greatest possible tumor dose. It is expected that by this procedure, the new radium technique will result in improvement of the final results as compared to the former tandem method.

In conclusion, the combination of preoperative irradiation, and hysterectomy six weeks later is endorsed as the method of choice in all operable cases of cancer of the corpus uteri. The multiple-capsule technique for the intrauterine radium treatment is preferred regardless whether the carcinoma is operable or inoperable. Perforation of the uterus resulted in only 1 case. T. LEUCUTIA, M.D.

Nolan, J. F., and Quimby, E. H.: Dosage Calculations for Various Combinations of Parametrial Needles and Intracervical Tandems. *Radiology*, 1943, 40: 391.

The purpose of this study was to calculate the distribution of radiation with various schemes of radium implantation and to compare the results with those published for other methods of treating cervix carcinoma. Theoretically the method proposed by the authors will yield a wider distribution of radiation in the pelvis because of the introduction of the radium sources directly into the parametria. Furthermore, the use of many weak sources rather than a few strong ones will tend to produce a more uniform field of radiation and eliminate the danger of extensive necrosis around individual sources.

The authors' calculations are based on standard conditions which are described and the methods used in their computations are given detailed consideration. Diagrams are included illustrating the different arrangements used. Variations in these combinations as to lateral position, angulation, and milligram-hour exposure have been studied. It has been noted that with these variations there are changes in the fields of radiation, and these changes, although small, are thought to be significant. Variations in positions of critical isodose levels in transverse plane through the internal os are tabulated under various conditions.

A comparison of tissue doses in gamma roentgens of four methods cited is shown diagrammatically, and the authors state that it is evident from this illustration that, if 6,000 roentgens is the minimum cancer lethal dose, none of the techniques considered here is adequate for treatment of possible pelvic lymph-node involvement. Supplementary irradiation with x-rays is essential to bring up the dosage level in this region. A. HARTUNG, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Wilson, H. E. C.: The Effect of Acid, Alkali, and Meals on the Blood Level and Excretion of Sulfapyridine in Children. *Brit. M. J.*, 1943, 1: 507.

The effect of sulfonamide drugs on the acid-base metabolism has received a certain amount of attention, without, however, any clear-cut conception as to the nature or cause of the upset having been obtained. After a short discussion of the findings of Beckman and of Hartman, and of their coworkers, Wilson describes his own experiments on the effect of acid and alkali on the blood level and excretion of sulfapyridine in children and the effect of timing the dosage in relation to meals.

Fifteen children were tested in the first group. Their ages varied from four to twelve years. They were chosen with diseases considered unlikely to interfere with absorption and excretion of the drug, e.g., chorea and epilepsy. Each child was given a single dose of 50 mgm. of sulfapyridine per kgm. of body weight. Blood levels were determined at one-, four-, and eight-hour intervals and the twenty-four-hour excretion in the urine was measured. The amount of free drug was estimated in the blood, but both the amount of free and combined drug was determined in the urine.

The author tabulates only averages, but concludes that there is no advantage in giving or withholding either acid or alkali. Individual figures varied widely. The only relatively constant feature was the percentage amount of the free and combined forms excreted in the urine in each individual case in the three modes of administration even when the total excretion varied.

There appeared to be no correlation between vomiting and the giving of acid or alkali.

A second series of 17 children was given the drug two hours before and immediately after the midday meal. Blood samples were collected four hours after administration of the drug, and the amount in the urine excretion collected for twenty-four hours was also determined. While the figures were again extremely variable, the average blood level was 0.5 mgm. per cent higher when the drug was taken immediately after a meal; it was too small an amount, however, to be of clinical significance.

MARION BARNES, M.D.

Meyenburg, H. von: Certain Principles Concerning Cancer in Our Army (Grundsaetzliches ueber den Krebs in unserer Armee). *Schweiz. med. Wschr.*, 1942, 72: 1079.

According to the Swiss law, drafted men are insured against results of diseases or injuries contracted during the service. The law does not specify that the disease must be caused by the service itself.

The author discusses three problems: (1) the causation of cancer by military service, (2) the unfavorable effects of military service on cancer, and (3) the question concerning the onset of the condition.

Very special conditions of the military service would be required for genesis of a cancer. For instance, repeated exposures to x-rays or to some new substance employed in the chemical warfare may act as carcinogenic agents. It goes without saying, that such cases are exceptional.

As to the influence of military service on the development of cancer, the author was unable to find in the literature any reference to any beneficial or unfavorable effect of physical strain on the cause of cancer. Occasionally a heavy physical strain may accelerate the progress of cancer.

As to the question of the onset of cancer, the beginning of the disease must be differentiated from the beginning of the tumor itself. As long as no symptoms are present, the tumor is no disease but an anatomic condition, the onset of which can never be exactly established. If the cancer disease became manifest during the service in the army, the patient is entitled to insurance. JOSEPH K. NARAT, M.D.

GENERAL BACTERIAL, PROTOZOAN, AND PARASITIC INFECTIONS

Westphal, R. S.: Human Trichinosis Following the Ingestion of Bear Meat. *J. Am. M. Ass.*, 1943, 122: 227.

It is generally believed that 90 per cent or more of human trichinosis occurs as the result of the ingestion of pork. However, according to reports, bears kept in captivity and those in their native habitat show a definite heavy infection with trichinosis. Cases have been reported of trichinosis resulting from the ingestion of beef, bear meat, and dog meat, but no case of human trichinosis following the ingestion of bear meat has hitherto been reported in New York State.

Westphal reports a case in which trichinosis developed after the ingestion of bear meat, among other foods; only the bear meat was available for analysis. Examination of the muscle from the shank revealed the presence of the trichinella spiralis.

SAMUEL KAHN, M.D.

Wile, U. J., and Kearney, E. B.: The Morphology of Treponema Pallidum in the Electron Microscope; Demonstration of Flagella. *J. Am. M. Ass.*, 1943, 122: 167.

In the investigation of bacteria, including treponema pallidum, with the electron microscope, a magnification of approximately 9,000 diameters has been found to give the best operating conditions,

although magnification of at least twice this amount is possible with the instrument.

In order to study the flagella-like processes more carefully, the photographic reproductions were enlarged tenfold. The processes resemble in all respects flagella which have been demonstrated in other bacterial forms, occurring at different levels of the organism; they have not yet been found at the end. There is, however, every reason to believe that they occur here as well as elsewhere.

The detection of flagella-like processes in preparations of treponema pallidum has been a sufficiently frequent finding to justify the assumption that they are an integral part of the organism, and probably are invariably present. The technical difficulties attendant on the preparation of fresh specimens from the human host together with the frequency with which debris interferes with good reproduction, accounts for their not being uniformly found.

The flagella-like structures found in the Noguchi rabbit strain of treponema pallidum appear to be identical with those described in the human strain.

SAMUEL KAHN, M.D

Atkinson, N.: Antibacterial Substances Produced by Micro-Organisms, with Special Reference to Those Produced by Molds. *Med. J. Australia*, 1943, 1: 359.

It is well known that in a mixed culture of micro-organisms one particular species frequently suppresses the growth of another. In many cases, this effect is due to the presence of definite metabolic products of the dominant species, nontoxic to itself but highly toxic to other species. Micro-organisms of many kinds may produce antibacterial substances which tend to have a selective action against certain bacteria.

Antibacterial substances may also be produced by molds. The best example in this group is penicillin, produced by penicillium notatum. It is evident that the capacity to produce such substances by micro-organisms is probably widespread. The author, therefore, tested various molds for inhibitory substances.

The medium for growing molds was that of Czapek-Dox for the production of penicillin. It was inoculated directly with molds growing naturally upon various materials. After six days of incubation at from 18° to 20° C., 17 of 39 molds tested showed some antibacterial activity. These 17 active molds could be divided into 2 groups according to their activity against the test organisms: bacterium coli, bacterium typhosum, corynebacterium diphtheriae mitis, staphylococcus aureus, and streptococcus viridans. Group 1 of the active molds caused inhibition of the growth of the staphylococcus aureus, streptococcus viridans, and corynebacterium diphtheriae, but did not inhibit the growth of the other two. Group 2 caused inhibition of the growth of all the test organisms.

It is interesting to note that all of the active molds are penicillia, and that group 1 was found only as a contaminant of culture media in the laboratory, while group 2 was found mainly on fruit. The other molds tested and found to be inactive were aspergilli, pink molds, and mucor from household produce and culture media.

Some of the molds were also tested after four and twelve days of incubation. The results showed that all of the active molds tested produced the active substance in four days, but in some cases the substance had disappeared after twelve days. The longer incubation period did not reveal activity in any molds previously shown to be inactive.

The activity of the molds of group 1 may be due to penicillin or to citrinin, both of which are produced by penicillia. In group 2, an antibacterial substance, hitherto undescribed for a penicillium, is responsible for the activity against bacillus typhosis.

SAMUEL KAHN, M.D.

EXPERIMENTAL SURGERY

Wakim, K. G., and Mann, F. C.: The Effects of Some Intra-Abdominal Operative Procedures on Intestinal Activity. An Experimental Study. *Gastroenterology*, 1943, 1: 513.

Various alterations of tone and activity of the small intestine follow anesthesia and operation, and may be responsible for some undesirable postoperative conditions. Previous reports by the authors concern the effects of anesthetic agents, while the present article deals with the effect of operations.

Trained dogs, in which a previously exteriorized loop of small intestine was covered with skin and with its circulation and nerve supply intact, were used in these experiments. Intestinal motility was registered kymographically through an airtight tambour system. All operations were performed under ether anesthesia with aseptic technique. Continuous kymographic tracings were taken for several days after laparotomy and intestinal anastomosis. Previous studies had shown that following a standard meal a wave of increased intestinal activity begins in the upper portion of the intestine and passes caudally. This feeding reaction was tested at various intervals after operation. The following results were observed.

1. Ether anesthesia and laparotomy led to practically complete cessation of intestinal activity for a minimum of four hours, but within twenty-four hours the activity was practically normal again.

2. Section and anastomosis of the intestine abolished intestinal activity for about forty-eight hours. Following this, rhythmic segmentation and peristaltic waves reappeared.

3. Feeding inhibited activity of the exteriorized loop when the site of section and anastomosis was proximal to the loop. After six days all movements and feeding reactions were similar to those recorded preoperatively.

JOHN A. GIUS, M.D.